

**COMPARISON OF THE EPA'S RCRA REQUIREMENTS AND THE NRC'S LICENSING
REQUIREMENTS FOR THE ON-SITE TREATMENT (IN TANKS & CONTAINERS) AND
STORAGE OF LOW-LEVEL MIXED WASTES AT NUCLEAR FACILITIES**

**U.S. Environmental Protection Agency
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FINAL DRAFT DOCUMENT

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FOR THE ON-SITE TREATMENT (IN TANKS & CONTAINERS) AND STORAGE OF
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Purpose

This document was prepared to present an evaluation of the degree of equivalence, in terms of protection to human health and the environment, between EPA's waste management requirements and the U.S. Nuclear Regulatory Commission's (NRC) requirements for the on-site treatment (in tanks and containers) and storage of low level waste (LLW). A line-by-line comparison of the requirements articulated by both EPA and NRC is neither appropriate nor feasible because the two agencies followed different approaches to protecting human health and the environment from the risks posed by the on-site treatment and storage of hazardous waste and LLW, respectively.

Specifically, EPA established minimum national standards which define the acceptable management of RCRA hazardous waste at facilities that treat, store, and/or dispose of such wastes. These minimum standards include the detailed design features and compliance procedures specified in 40 CFR Part 264. The NRC, on the other hand, requires demonstrations of compliance with the design and performance-based objectives and standards discussed in Chapter I of 10 CFR and various guidance documents for radioactive wastes. NRC relies on detailed site-specific analyses of the applicant's site, plant design, plant operating procedures, and waste characteristics, along with site-specific requirements, to ensure that every licensee limits radiation exposure to occupationally exposed individuals and the public to "as low as reasonably achievable" (or ALARA).

Background

The NRC was established as an independent agency by Congress under the Energy Reorganization Act of 1974 to ensure that civilian uses of nuclear materials in the United States -- in the operation of nuclear power plants, and in medical, industrial, and research operations -- are carried out with adequate protection of the public health and safety, of the environment, and of national security.

NRC carries out its mission through various licensing, inspection, research, and enforcement programs. Currently, NRC responsibilities include regulating 110 commercial nuclear power reactors; 43 non-power reactors, 8 major uranium fuel cycle facilities; 2 uranium enrichment gaseous diffusion plants, and approximately 23,000 licenses issued for medical, academic, and industrial uses of nuclear material (includes Agreement States which oversee the majority of material licensees).

Waste Generation at Nuclear Facilities

Commercial nuclear power facilities and other nuclear facilities generate various types of radioactive and mixed wastes, including:

- C High-Level Radioactive Waste/Spent Fuel
- C Transuranic Waste
- C Low-Level Radioactive (Non-Mixed and Mixed) Waste

Although high-level mixed waste and transuranic mixed waste both are generated in large amounts as a result of nuclear fuel production and regeneration activities, the focus of our regulatory analysis is on low-level radioactive waste, which is generated by both nuclear power facilities and other nuclear facilities (material licensees).

Low-Level Radioactive Waste

Low-level radioactive waste generally includes residues from water treatment systems, particularly residues from reactor water treatment systems, as well as other materials that have become contaminated with radioactive material or have become radioactive through exposure to neutron radiation. Such waste can include equipment and tools, protective clothing, filters, cleaning materials, discarded parts, waste oils, and similar materials.

Mixed Radioactive Waste

Mixed waste contains both radioactive waste and hazardous waste. There are five major categories of generators of low-level mixed waste (LLMW). The major generators include industrial facilities, medical and academic institutions, government facilities, and commercial nuclear power plants.

Mixed Radioactive Waste

RCRA, as amended by the Federal Facility Compliance Act of 1992, defines mixed waste as a waste that contains both hazardous waste and source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954 (RCRA §1004(41)).

Low-Level Radioactive Waste

Under the Low-Level Radioactive Waste Policy Amendments Act, codified in 42 U.S.C.A §10101, low-level waste is radioactive material that “is not high-level radioactive waste, spent nuclear fuel, transuranic waste, or by-product material as defined in section 2014(e)(2) of this title. . . .” The NRC similarly defines low-level waste in 10 CFR §61.2 as the following:

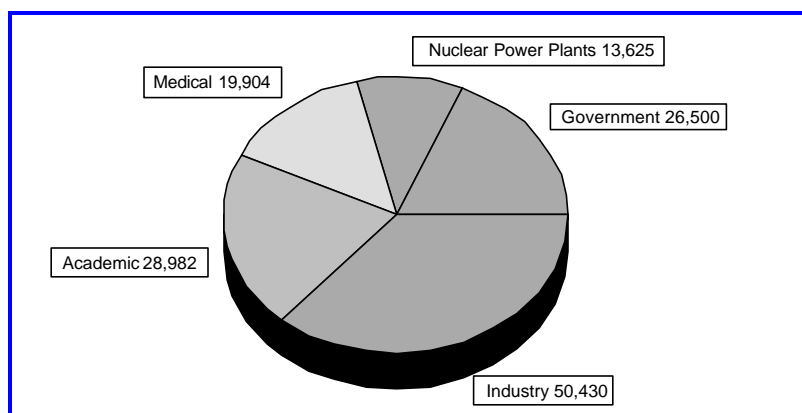
“Waste means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level waste has the same meaning as in the Low-Level Waste Policy Act, that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).”

Within each of these categories of generators, there are a number of different facility types generating LLMW; however, LLMW is typically generated by the same activities regardless of the generator/facility type. Typical waste generating activities include: laboratory counting procedures (for radioactivity); research, manufacturing and regeneration of reagents; cleaning of laboratory equipment; cleaning of contaminated components and equipment; and contaminated lead shielding. The most predominant wastes generated across all of the major generating sectors include: liquid

scintillation cocktails (LSCs), organic chemicals, and lead wastes. Exhibit 1 presents the quantities of LLMW generated by facility type in 1990.¹ As shown in Exhibit 1, nearly 140,000 cubic feet of LLMW was generated in 1990; the bulk of the LLMW was generated by industrial licensees, rather than by nuclear power generating facilities.

¹Oak Ridge National Laboratory for the U.S. Nuclear Regulatory Commission, *National Profile on Commercially Generated Low-Level Radioactive Mixed Waste*, NUREG/CR-5938, ORNL-6731, 1992 p. 73. This exhibit was recreated from page 73 of the *National Profile*.

Exhibit 1
Quantities of LLMW Generated by Facility Type (1990)
(Weighted - ft³/yr)



Format

The remainder of this report is organized as follows. In Section A, we present the evaluation of the degree of equivalence between EPA's RCRA framework and NRC's framework for the on-site treatment (in tanks and containers) and storage of LLW at nuclear facilities. To facilitate the comparison and evaluation of each of the applicable RCRA (40 CFR Part 264) regulations to the corresponding NRC requirements, we first present a brief summary of the specific RCRA regulation and a discussion of the intent of that RCRA regulation. We then provide a brief summary of the corresponding NRC requirement and a discussion of the intent of that NRC requirement. Lastly, we present our comparison of the intent of the two programs to supply the basis for a determination of whether the two frameworks offer equivalent protection to human health and the environment. In Section B, we present a similar evaluation for other nuclear facilities that are regulated by NRC (and Agreement States) as material licensees.

The following RCRA requirements were compared to the corresponding NRC requirements in this report:

40 CFR Part 264, Subpart B - General Facility Standards

- C 264.14 - Security
- C 264.15 - General Facility Inspection
- C 264.16 - Personnel Training
- C 264.17 - General Requirements for Ignitable, Reactive, or Incompatible Wastes
- C 264.18 - Location Standards

40 CFR Part 264, Subpart C - Preparedness and Prevention

- C 264.35 - Required Aisle Space
- C 264.37 - Arrangements With Local Authorities

40 CFR Part 264, Subpart D - Contingency Plan and Emergency Procedures

- C 264.51 - Purpose and Implementation of Contingency Plan
- C 264.52 - Content of Contingency Plan
- C 264.53 - Copies of Contingency Plan
- C 264.54 - Amendment of Contingency Plan
- C 264.55 - Emergency Coordinator
- C 264.56 - Emergency Procedures

40 CFR Part 264, Subpart E - Record Keeping and Reporting

- C 264.73 - Operating Record
- C 264.74 - Availability, Retention, and Disposition of Records
- C 264.75 - Biennial Report

40 CFR Part 264, Subpart I - Use and Management of Containers

- C 264.171 - Condition of Containers
- C 264.172 - Compatibility of Waste with Containers
- C 264.173 - Management of Containers
- C 264.175(a)-(b) - Containment of Liquids
- C 264.175(c) - Containment of Non-Liquids
- C 264.176 - Special Requirements for Ignitable or Reactive Waste
- C 264.177 - Special Requirements for Incompatible Wastes
- C 264.178 - Closure

40 CFR Part 264, Subpart J - Tank Systems

- C 264.191 - Assessment of Existing Tank System's Integrity
- C 264.192 - Design and Installation of New Tank Systems or Components
- C 264.193 - Containment and Detection of Releases
- C 264.194 - General Operating Requirements
- C 264.195 - Inspections
- C 264.196 - Response to Leaks or Spills and Disposition of Leaking or Unfit-For-Use Tank Systems

40 CFR Part 264, Subpart DD - Containment Buildings

- C 264.1101(a) - Design Standards
- C 264.1101(b) - Containment of Liquids
- C 264.1101(c) - Operating Standards
- C 264.1101(d) - Special Requirements for Containment Buildings
- C 264.1102 - Closure and Post-Closure

Summary of Findings

EPA determined that the NRC program for the on-site treatment (in tanks and containers) and storage of LLW at nuclear facilities, when focusing on safety, is as stringent and at least as protective of human health and the environment as the corresponding RCRA requirements for owners and operators of hazardous waste treatment and storage facilities. As discussed earlier, EPA and NRC followed different approaches for protecting human health and the environment; while EPA chose to be prescriptive and establish minimum national standards with specific design specifications and procedural requirements, NRC chose to require demonstrations of compliance with design and performance-based objectives and standards. Despite the philosophical differences between the two regulatory approaches, both agencies obtain the same degree of protection; however, we did identify the following instances where minor differences in either administrative or procedural requirements existed:

- C General Facility Inspection/Container Inspections. Although both programs allow facilities to base the frequency of inspection on the rate of deterioration of the equipment and the probability of an incident, the RCRA program requires an inspection frequency of at least weekly. NRC requires licensees to conduct at least a quarterly inspection; however, if based upon the rate of deterioration of the equipment, containers, or the probability of an incident, the licensee would be required to either redesign the equipment or container and/or increase the frequency of inspection to account for the rate of corrosion or probability of an incident.
- C Record Keeping Requirements. RCRA stipulates that details of the closure and post-closure cost estimates be kept in the site's operating record. NRC, however, requires nuclear power facilities to submit a preliminary decommissioning cost estimate to NRC at, or about five years prior to the projected end of operations, and material licensees to maintain such information at an identified location until the site is released for unrestricted use.
- C Biennial Reporting Requirements. EPA requires the owner/operator to submit a biennial report that includes, among other things, waste generation rates and waste management/disposition information. NRC does not require facilities to submit biennial reports.
- C Inspection Requirements for Tank Systems and Subpart DD - Liquids Containment. With respect to the RCRA requirements that both containment leak detection monitors/systems and tank systems need to be subjected to daily monitoring and inspections, the NRC's program differs only by allowing the licensee to determine the required frequency based on the rate of deterioration of the equipment and the probability of an incident; all tanks and containers are required to have provisions to monitor liquid levels and to alarm potential overflow conditions.
- C Removal of Wastes From Tank Systems and Containment Systems. RCRA requires that the collected liquid/wet waste be removed from the tank system and/or secondary containment system within 24 hours of detection (or the earliest practicable time), whereas, NRC requires that (1) licensees make provisions for sampling and treating all collected liquids, and (2) removal occurs as soon as it is safe for occupationally exposed individuals to enter an area.
- C Closure and Post-Closure Care. Under the RCRA program, facilities must remove all *RCRA hazardous waste and contaminated components* from the non-disposal portions of the facility. Whereas under the NRC framework, for a site to be considered acceptable for unrestricted use, licensees must decontaminate and decommission facilities so that (1) the *residual radioactivity* that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem per year and (2) *the residual radioactivity* has been reduced to levels that are ALARA. (This value includes doses

received from groundwater sources of drinking water and is based on a specific dose level that NRC determined to be protective of the public health and the environment.)

The following only applies to Material Licensees (and not nuclear power plants):

- C Containment of Liquids. RCRA has prescriptive requirements to ensure that storage areas are designed to prevent liquids (or mixtures of waste/precipitation) from either overflowing (or leaking from) the storage facility's containment system, so as to prevent waste containers from being in direct contact with collected liquids. The NRC requirements, however, emphasize packaging design and require that the waste package include a containment system capable of containing releases for as long as the waste remains in storage. In addition, NRC expects that LLW will be shielded from the elements and from extremes of temperature and humidity; therefore, provisions for collecting, containing, and removing precipitation are not specifically required. In any case, NRC expects that licensees will have procedures and equipment in place (or have access to equipment) necessary to both respond to spills or leakage of LLW from containers and repackage the waste, should the need arise.

A. COMPARISON OF THE EPA’S RCRA REQUIREMENTS AND THE NRC’S LICENSING REQUIREMENTS FOR THE ON-SITE TREATMENT (IN TANKS & CONTAINERS) AND STORAGE OF LOW-LEVEL MIXED WASTES AT NUCLEAR POWER PLANTS

Introduction

There are 110 commercial nuclear power reactors in the United States, of which 103 are currently operating in 32 States (seven facilities are closed and undergoing decommissioning). All nuclear power reactors are licensed directly by the NRC under the authority of the Atomic Energy Act, as amended, and Title 10 of the Code of Federal Regulations.

The NRC regulates civilian uses of nuclear materials through the issuance of performance-based regulations, regulatory guides, generic communications, and NUREGs. NRC uses the various regulatory guides, generic communications, and NUREGs to guide licensees on how to meet the intent of the regulations. These documents work together to enable the NRC to ensure that nuclear power facilities are operating in a manner that is safe to both human health and the environment.

NRC Regulations

NRC regulations of interest for nuclear power plants are found at 10 CFR Chapter I -- Nuclear Regulatory Commission; a partial listing of the parts most relevant to the construction and operation of nuclear power facilities and the management of radioactive waste includes:

- 10 CFR 20 - Standards for Protection Against Radiation
- 10 CFR 50 - Domestic Licensing of Production and Utilization Facilities
- 10 CFR 50
 - Appendix A - General Design Criteria for Nuclear Power Plants
- 10 CFR 50
 - Appendix I - Numerical Guides for Design Objectives and Limiting Conditions for Operation Guides to Meet the Criterion as Low as is Reasonably Achievable for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents

In general, the management of LLW is subject to a broad range of regulatory provisions. Licensees of nuclear power plants are required by NRC’s general radiation protection standards (10 CFR Part 20) to ensure that radioactivity levels released to the environment are as low as reasonably achievable (ALARA).² The 10 CFR 50 regulations pertain to the process of obtaining a construction permit; preparing a license application, which also includes the preliminary and final safety analysis reports; and the controlling, monitoring, and reporting of the release of radioactive materials to the environment. Appendix A of Part 50 stipulates the “General Design Criteria for Nuclear Power Plants,” which are provided as criteria. The relevant criteria include:

- C **Criterion 60** -- *Control of Releases of Radioactive Materials to the Environment*
- C **Criterion 61** -- *Fuel Storage and Handling and Radioactivity Control*
- C **Criterion 63** -- *Monitoring Fuel and Waste Storage*
- C **Criterion 64** -- *Monitoring Radioactivity Releases*

²Waste management is also subject to standards set by EPA under 40 CFR Part 190.

NRC Regulatory Guides and Other Documents

NRC uses Regulatory Guides and NUREGs (NRC technical reports) to describe acceptable methods of implementing NRC regulations. One of the most relevant Regulatory Guides of interest for nuclear power facilities is **Regulatory Guide 1.143** - “*Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants*,” Revision 1, October 1979. NRC prepared this guide to provide information and criteria that will provide reasonable assurance that components and structures used in the radioactive waste management and steam generator blowdown systems are designed, constructed, installed, and tested on a level commensurate with the need to protect the health and safety of the public and plant operating personnel. It also set forth minimum staff recommendations and was not intended to prohibit the implementation of more rigorous design considerations, codes, standards, or quality assurance measures. A summary of the minimum design criteria set forth by the guide for systems handling radioactive liquids, gases, and solid wastes include the following:

- C **Compatibility.** Construction materials should be compatible with the chemical, physical, and radioactive environment of specific applications during normal conditions and anticipated operational occurrences.
- C **Structural Design Criteria.** Foundations and walls of structures that house the radwaste systems should be designed to withstand seismic events and be of height sufficient to contain the maximum liquid inventory expected to be in the building.
- C **Spill Controls.** Radioactive waste management structures, systems, and components should be designed to control leakage and facilitate access, operation, inspection, testing, and maintenance in order to maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable.

NRC issues generic communications (bulletins, generic letters, information notices, and administrative letters) to inform groups of licensees about specific problems, developments, or other matters of interest to the licensees. NRC also uses generic letters to request licensees to take specific actions or require them to submit information. Several of the more important generic communications of interest to nuclear power facilities concerning the management of radioactive wastes include:

- C **IE Circular No. 80-18**, “*10 CFR 50.59 Safety Evaluations for Changes to Radioactive Waste Treatment Systems*,” August, 1980.
- C **Generic Letter 81-38**, “*Storage of Low-Level Radioactive Wastes at Power Reactor Sites*,” and Enclosure, “*Radiological Safety Guidance for Onsite Contingency Storage Capacity*,” November 10, 1981.
- C **Generic Letter 80-051**, “*Letter to Licensees Concerning On-Site Storage of Low-Level Waste*,” and Enclosure “*Safety Consideration for Temporary On-Site Storage of Low-Level Radioactive Waste*,” June 9, 1990.

NRC prepares reports on a wide range of topics including, technical and regulatory reports of general applicability, such as information supporting regulatory decisions, guidance for meeting NRC regulations, results of task force investigations of specific topics or incidents, analyses of certain regulatory programs, proceedings of conferences and workshops, and administrative information of interest to the staff, the industry, and the public. NRC also has prepared standard review plans and application guidance to make information about the regulatory licensing process widely available and to improve the understanding of the staff’s review process widely available and to improve interested members of the public and the nuclear

industry's understanding of the staff's review process. These documents are designated as NUREGs and specific NUREG documents of interest for nuclear power plants include:

- C **NUREG-0800**, *“Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR (Light Water Reactor), Edition,”* July 1981 (as updated).
- C **Management Directive 8.6** - *“Systematic Assessment of Licensee Performance (SALP).”* (Note: this program was recently discontinued and is being replaced by a new program entitled “The Regulatory Oversight Process.” This new program began testing in June 1999 and should be implemented in early 2000.)
- C **Various Inspection Procedures Utilized by NRC.** NRC has prepared numerous inspection procedures to enable NRC inspectors to determine whether the radwaste treatment and storage facilities and procedures are adequate and meet the intent of the various regulations, guides, and generic communications concerning the management of radwaste. These procedures cover factors such as whether:
 - the licensee has provided an adequate safety evaluation for construction and operation of the facility
 - quality assurance plans, instructions, and procedures have been established
 - adequate construction procedures have been established
 - construction of the as-built facility was consistent with NRC requirements and licensee commitments
 - changes to organization and staffing with regard to the LLW storage facility agree with applicable requirements of the Technical Specifications and with FSAR and other licensee commitments
 - effective training and qualification programs exist for personnel assigned to the LLW storage facility
 - adequate procedures have been established for routine operation of the LLW storage facility
 - there have been any changes to the facility or facility operations that could affect effluent monitoring requirements

Licensing Process

Applicants submit an application for an operating license (which is granted in two phases - construction permit and operating license). The application must contain all of the information required by 10 CFR 50.33. In addition, as per 10 CFR 50.34, the applicant also must present a Safety Analysis Report (SAR), which in the initial phase of licensing is termed the “Preliminary Safety Analysis Report” (PSAR). The PSAR must be sufficiently detailed to permit the NRC to determine whether the plant can be built and operated without undue risk to the health and safety of the public. Prior to submission of a PSAR, an applicant should have designed and analyzed the plant in sufficient detail to conclude that it can be built and operated safely.

The SAR is the principal document in which the applicant provides the information needed to understand the basis upon which this conclusion has been reached. Section 50.34 specifies, in general terms, the information to be supplied in a SAR. The specific information required by the staff for an evaluation of an application is identified in Regulatory Guide 1.70, “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants - LWR Edition.” The Standard Review Plan (SRP) sections are keyed to the Standard Format, and the SRP sections are numbered according to the section numbers in the Standard Report.

The NRC uses NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," to guide their review of the applicant's PSAR. If the PSAR is determined to be adequate, and after a public comment process, the NRC grants a construction permit (CP). The applicant can then begin construction of their nuclear power plant.

Once the construction of the nuclear power plant has reached the point where all of the design details have been worked out and the plans for operation of the facility have been finalized, the applicant then submits, as an amendment to their initial application, a Final Safety Analysis Report (FSAR) to the NRC for review. If the NRC determines that an operating license should be granted, the NRC holds a public hearing, resolves any public concerns, and then grants an operating license.

In the remainder of this section, we present brief summaries of the RCRA regulations, the intent of the RCRA regulations, the NRC requirements, the intent of the NRC requirements, and a comparison of the intent of the two programs.

A.1 SECURITY

A.1.1 RCRA Requirements

40 CFR 264.14(a) requires that the owner/operator demonstrate to the regional administrator that physical contact with the waste or equipment within the facility will not cause injury to unknowing or unauthorized individuals and disturbance of the waste or equipment by unauthorized individuals will not violate security requirements. If the owner/operator is unable to successfully demonstrate these requirements, he/she must undertake the following activities:

- C Maintain a 24-hour surveillance system or build an artificial or natural barrier which completely surrounds the active portion of the facility.
- C Post a sign with the legend, "Danger—Unauthorized Personnel Keep Out," at each entrance to the active portion of the facility, and at other locations, in sufficient numbers to be seen from any approach to the active section.

A.1.2 Intent of RCRA Requirements

To prevent the unauthorized handling of waste and unauthorized entry into waste storage areas, thereby protecting the health of both untrained individuals working around the storage area and members of the general public.

A.1.3 NRC Requirements

Security-specific regulations and requirements for the control of licensed materials (including waste) are contained in 10 CFR 20.1801 and 20.1802, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedure 84900 and include the following:

- C Securing from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas (10 CFR 20.1801);
- C Controlling and maintaining constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage (10 CFR 20.1802);
- C Prior to any implementation of additional on-site storage, substantial safety reviews and environmental analysis need to be conducted to meet minimal requirements in areas of design considerations, operational considerations, safety considerations and policy considerations;
- C The quantity of radioactive material allowed and the shielding configurations of waste placed in storage are dictated by the dose rate criteria for both the site boundary and unrestricted areas onsite. The 40 CFR 190 limits will restrict the annual dose from direct radiation and effluent release to the Public (individual) to less than 25 mrem per year to the whole body from all sources of the Uranium fuel cycle; therefore, off-site doses from on-site storage must be sufficiently low to account for other sources (e.g., < 1 mrem/year). On-site dose limits associated with temporary storage will be controlled per 10 CFR Part 20 including the ALARA principle as defined in 10 CFR 20.2001;
- C If adequate space in the protected area is not available, the storage facility should be placed on the plant site and both a physical security program (e.g., fence, locks or alarmed gates/doors, periodic patrols) and a restricted area for radiation protection purposes should be established;
- C All solidified radioactive waste and low level dry radioactive should be located in restricted areas where effective material control and accountability can be maintained; and
- C NRC inspectors review the licensee's accountability and security procedures for the waste and inspect the storage area(s) regularly to assure its adequacy with respect to access control and security.

A.1.4 Intent of NRC Requirements

To require licensees to construct and properly operate well-designed storage facilities that limit radiation exposures to both occupationally exposed individuals (regardless of training) and members of the general public to ALARA through design considerations and controlling access to waste storage areas.

A.1.5 Comparison of Intent

The intents of the two programs are equivalent, as they require facilities to limit access to waste storage areas through use of physical barriers thereby preventing the unauthorized entry or handling of waste in storage.

A.2 GENERAL FACILITY/CONTAINER INSPECTION REQUIREMENTS

A.2.1 RCRA Requirements

40 CFR 264.15(a)-(d) requires the owner or operator to undertake the following activities:

- C Inspect the facility for malfunctions, deterioration, operator errors, and discharges which may be causing--or lead to--hazardous waste release or a threat to human health.
- C Develop and follow a written schedule for inspecting monitoring, safety and emergency equipment. This schedule must be kept at the facility and identify the types of problems which are to be examined during inspection. The frequency of inspection may vary according to the items on the schedule.
- C Remedy any deterioration or malfunction of equipment and structures.
- C Maintain and record inspections in an inspection log for a period of three years from the date of inspection.

40 CFR 264.174 and 264.1101(c)(4) also require the owner/operator to inspect the container storage area or containment building, respectively, at least weekly, looking for leaking containers and for deterioration of containers and the containment system caused by corrosion or other factors.³

A.2.2 Intent of RCRA Requirements

The intent of the RCRA requirements is twofold. First, to develop and implement comprehensive waste storage/container area inspection, repair, and record keeping procedures so as to minimize/prevent exposure to employees and the general public resulting through release-related accidents. Second, to require facilities to maintain inspection logs for a predetermined period of time, so that regulatory compliance can be verified and to allow for the identification and correction of recurring incidents.

A.2.3 NRC Requirements

Inspection-related regulations and requirements are contained in 10 CFR 20.1101, 10 CFR 20.1302, 10 CFR 50 (Appendix A), Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), Regulatory Guide 1.143, and Inspection Procedures 65051, 84101, 84522, 84750, 86750, and 84900, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures as inspecting containers as often as necessary.)
- C As appropriate, surveys of radiation levels in unrestricted and controlled areas (plant environs, including radioactive waste systems and associated handling areas) and radioactive materials in effluents released to unrestricted and controlled areas that may be released from normal operations, including anticipated operational occurrences and from postulated accidents, should be performed to (1) demonstrate compliance with the dose limits for individual members of the public, and (2) initiate appropriate safety actions.

³40 CFR 264.15(c) and 264.171 require remedial action for deterioration or leaks detected.

- C The potential release pathways of all radionuclides present in the solidified waste form should be monitored and surveillance programs should incorporate adequate methods for (1) detecting failure of container integrity and (2) measuring releases to the environment to insure that levels are below limits specified in 10 CFR Part 20.
- C A program of at least periodic (quarterly) visual inspection of container integrity (swelling, corrosion products, breach) should be performed. Inspection can be accomplished by use of TV monitors; by walk-throughs if storage facility layout, shielding, and the container storage array permit; or by selecting waste and containers stored in the facility and placing them in a location specifically designed for inspection purposes. All inspection procedures developed should minimize occupational exposure. The use of high integrity containers would permit an inspection program of reduced scope.
- C Radioactive waste management structures, systems, and components should be designed to facilitate access, operation, inspection, and testing in order to maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable. With regard to liquid radioactive waste storage, all tanks and containers are required to have provisions to monitor liquid levels and to alarm potential overflow conditions. With regard to solidified waste storage containers, (1) procedures should be developed and implemented for early detection, prevention and mitigation of accidents (e.g., fires); and (2) storage areas and facility designs should incorporate good engineering features and capabilities for contingencies so as to handle accidents and provide safeguard systems such as fire detectors and suppression systems, (e.g., smoke detectors and sprinklers).
- C Inspectors are required to check whether the licensee has (1) provided an adequate safety evaluation for construction and operation of the facility; (2) adequately responded to findings from previously conducted audits and appraisals (e.g., revised procedures, made commitments, or taken corrective actions to prevent recurrence); (3) complied with effluent requirements and efforts to keep effluents ALARA; (4) adequately installed, calibrated, and tested process monitors for the solid waste system; (5) effectively controlled, monitored, and quantified releases of radioactive materials in liquid, gaseous, and particulate forms to the environment; (6) provided management approved, detailed instructions and operating procedures for all personnel involved in the transfer, packaging, and transport of low-level radioactive waste with special attention given to controls on the chemical and physical form of the radioactive material and on the containment integrity of the packaging; (7) adequate storage area(s); and (8) adequate package integrity and labels.

A.2.4 Intent of NRC Requirements

To ensure that waste handling and storage facilities are properly designed and well operated to facilitate the inspection of container integrity and monitoring of radiation, so as to detect, prevent, and mitigate accidents.

A.2.5 Comparison of Intent

The intents of the two programs are equivalent in that both EPA and NRC require facilities to inspect equipment and waste containers to detect integrity-related mishaps from occurring in the first place. Although both programs allow facilities to base the frequency of inspection on the rate of deterioration of the equipment and the probability of an incident, the RCRA program requires an inspection frequency of at least weekly. NRC requires nuclear power reactor licensees to conduct at least a quarterly inspection; however, if based upon the rate of deterioration of the equipment, containers, or the probability of an incident, the licensee would be required to either redesign the equipment or container and/or increase the frequency of inspection to account for the rate of corrosion or probability of an incident. Lastly, both programs also require facilities to update their inspection procedures to reflect current operating conditions and to account for "lessons learned."

A.3 **PERSONNEL TRAINING**

A.3.1 RCRA Requirements

Under 40 CFR 264.16(a)-(e) all facility personnel are required to undertake the following activities:

- C Complete a program of classroom instruction or on-the-job training that is directed by a person trained in hazardous waste management procedures, and which teaches procedures (including contingency plan implementation) relevant to the positions occupied by the facility personnel. The program must familiarize facility personnel with emergency procedures and systems.
- C Successfully complete the program within six months of the date of their employment or assignment to the facility, or to a new position at a facility, whichever is later.
- C Take part in an annual review of the initial training.

In addition, the owner/operator must maintain the job description and training records of all personnel until closure of the facility.

A.3.2 Intent of RCRA Requirements

The intent of the RCRA program is twofold. First, to institute mandatory, annual training requirements for individuals working/handling hazardous waste so that they will have the knowledge to properly manage waste, prevent spills, and implement emergency response actions. Second, to document that workers receive initial training and to ensure that workers receive annual refresher training.

A.3.3 NRC Requirements

Personnel training-related regulations and requirements are contained in 10 CFR 19.12, 10 CFR 20.1101, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedures 65051 and 86750, and include the following:

- C Occupationally exposed individuals should be kept informed of the storage, transfer, or use of radiation and/or of radioactive material, and should be instructed in (1) the health protection problems associated with exposure to radiation and/or radioactive material, (2) the precautions or procedures to minimize exposure, and (3) the purposes and functions of protective devices employed, if the likely exposure to these individuals exceeds 100 mrem/yr.

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include operating practices such as training to ensure that occupational doses are ALARA.)
- C Licensees are required to establish personnel training and administrative procedures to insure both control of radioactive materials and minimum personnel exposures.
- C NRC inspectors are required to determine whether an effective training and qualification program exists for personnel assigned to the LLW storage facility. Specifically, they (1) review the applicable education, experience, qualifications, and training of selected employees of the licensee (and its contractors) that are responsible for processing, testing, storage, and shipping (including certification) of LLW and transportation of other radioactive materials; (2) determine if the licensee has provided training and periodic retraining in the DOT and NRC regulatory requirements, the waste burial license requirements, and in the instructions and operating procedures for all personnel involved in the transfer, packaging, and transport of radioactive waste; (3) determine if the licensee has provided training and periodic retraining to those employees of the licensee (and its contractors) who operate the processes that generate radioactive waste to ensure that the volume of waste is minimized and is processed into acceptable chemical and physical form for transfer and shipment to a LLW burial facility; (4) determine if the licensee has incorporated the results of “lessons learned,” as a result of any violations and corresponding corrective action which may have occurred since the last inspection, into lesson plans for employees who operate low-level waste processing equipment or for personnel involved in the transfer, packaging, and transport of radioactive material; and (5) assess if the licensee has provided management approved, detailed instructions and operating procedures for all personnel involved in the transfer, packaging, and transport of low-level radioactive waste with special attention given to controls on the chemical and physical form of the radioactive material and on the containment integrity of the packaging.

A.3.4 Intent of NRC Requirements

The intent of the NRC program also is twofold. First, to institute mandatory, annual training requirements for individuals working/handling LLW so that they will have the knowledge to properly manage waste, prevent spills, and implement emergency response actions. Second, to document that occupationally exposed individuals receive initial training and to ensure that occupationally exposed individuals receive annual refresher training.

A.3.5 Comparison of Intent

The intents of the two programs are equivalent, as both programs require facilities to develop and implement employee training programs to ensure that workers are (and remain) (1) trained in conducting their jobs safely and (2) that they will have the knowledge to properly manage waste, prevent spills, and implement emergency response actions. Although EPA’s program is focused on the non-radiological hazards (toxicity, reactivity, ignitability, explosivity, etc.) and NRC’s program is focused on the radiological hazards of the waste, all U.S. facilities are subject to the training requirements established by both the Occupational, Safety, and Health Agency (OSHA) for protecting worker safety from hazardous chemicals and situations (including hazard communication requirements - posting of Material Safety Data Sheets for hazardous products used, etc.) and the Department of Transportation (DOT) requirements for the safe transport of hazardous materials. Furthermore, in accordance with NRC requirements to both safely manage LLW and prevent releases of LLW, any hazard (chemical or other) that could affect the safe operation of the nuclear power plant and handling of associated wastes needs to be considered in the design of the facility and accounted for in the plant’s operating procedures.

A.4 GENERAL REQUIREMENTS FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTES

A.4.1 RCRA Requirements

CFR 264.17(a)-(b) stipulates that the owner/operator must take precautions to prevent accidental ignition or reaction of ignitable or reactive waste, such as through waste segregation, warning signs, and use of appropriate protective measures (e.g., fume hoods and “No Smoking” signs). In mixing incompatible or incompatible wastes and other materials, the owner/operator must ensure against uncontrolled releases such as fire, explosion, and fumes.

A.4.2 Intent of RCRA Requirements

To require the owner/operator to take the necessary, precautionary measures to prevent accidental ignition, reaction of ignitable wastes, releases, explosions, and fume generation resulting from improper mixing procedures or from the inherent instability of some wastes.

A.4.3 NRC Requirements

NRC regulations and requirements related to ignitable, reactive, or incompatible wastes are contained in 10 CFR 20.1101, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), NUREG-0800, and Inspection Procedure 84900, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to prevent and/or mitigate dangerous conditions resulting from the accidental ignition/reaction of incompatible waste materials.)
- C The acceptance criteria of any proposed storage facility or area will need to meet minimal requirements in areas of design, operations, safety considerations and policy considerations. The major emphasis will be on safety considerations in the storing, handling and eventual disposition of the radioactive waste.
- C Procedures should be developed and implemented for early detection, prevention and mitigation of accidents (e.g., fires). Storage areas and facility designs should incorporate good engineering features and capabilities for contingencies so as to handle accidents and provide safeguard systems such as fire detectors and suppression systems, (e.g., smoke detectors and sprinklers).
- C Licensees are required to design features to preclude the possibility of an explosion if the potential for explosive mixtures exists.
- C Licensees are required to implement controls to segregate and minimize the generation of low-level dry waste to lessen the impact on waste storage.
- C Inspectors are required to inspect the storage area(s) to assure its adequacy with respect to protection from fire and flooding, environmental elements, avoidance of temperature/humidity extremes, ventilation considerations, and package integrity and labeling.

A.4.4 Intent of NRC Requirements

To require facilities to consider the chemical properties (including ignitability, reactivity, explosivity, etc.) of the LLW in both the design of, and the writing of standard operating procedures for the facility and associated waste handling systems, storage containers, and storage areas to prevent accidental ignition, reaction of ignitable wastes, releases, explosions, and fume generation resulting from improper mixing procedures or from the inherent instability of some LLW.

A.4.5 Comparison of Intent

The intents of the two programs are equivalent in that both require the anticipation, recognition, and prevention of accidental ignition, reaction of ignitable wastes, releases, explosions, and fume generation resulting from improper mixing procedures or from the inherent instability of some wastes.

A.5 LOCATION STANDARDS

A.5.1 RCRA Requirements

40 CFR 264.18(a)-(c) establishes the following location standards for the siting of treatment, storage, and disposal facilities:

- C Prohibits the siting of portions of new facilities where treatment, storage or disposal occurs within 61 meters (200 feet) of a fault which has had displacement in Holocene time.
- C Stipulates that a facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless EPA provides otherwise.
- C Prohibits the placement of any noncontainerized or bulk liquid hazardous waste in any salt dome formation, salt bed formation, underground mine, or cave.

A.5.2 Intent of RCRA Requirements

To ensure that facilities are constructed in areas not subject to seismic activity and if sited in a 100-year floodplain, that sufficient design and operating controls be implemented to prevent the washout of waste from the facility.

A.5.3 NRC Requirements

NRC regulations and requirements related to facility location are contained in 10 CFR 50.34, 10 CFR 100, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Regulatory Guide 1.143, and include the following:

- C Each application for a construction permit shall include a preliminary safety analysis report, which must be sufficiently detailed to permit the NRC to determine whether the plant can be built and operated without undue risk to the health and safety of the public.
- C NRC evaluates the following factors when determining the acceptability of a site for a stationary power reactor: (1) whether population density and use characteristics of the site environ, including the exclusion area, the population distribution, and site-related characteristics when determining whether individual as well as societal risk of potential plant accidents is low, and that physical characteristics unique to the proposed site that could pose a significant impediment to the development of emergency plans were identified; (2) whether the nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military, and chemical facilities)

were evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low; and (3) the physical characteristics of the site, including seismology, meteorology, geology, and hydrology.

- C Licensees are required to evaluate accident mitigation and control for design-based events (e.g., fire, flooding, tornadoes, etc.) and protect against them.
- C If possible, the preferred location of the storage facility should be inside the plant protected area. The facility should not be placed in a location that requires transportation of the waste over public roads unless no other feasible alternatives exist. Any transportation over public roads must be conducted in accordance with NRC and DOT regulations.
- C Foundations and walls of structures that house the solid waste radioactive system are required to be designed according to the seismic criteria established in regulatory position 5 of Regulatory Guide 1.143, and to a height sufficient to contain the maximum liquid inventory expected to be in the building. With regard to solidified waste storage, licensees are required to ensure that accident mitigation and control for design basis events (e.g., fire, flooding, tornadoes, etc.) are evaluated and will be protected against such events unless otherwise justified.
- C Structures that house liquid radwaste storage tanks should be designed to seismic criteria as defined in NRC's Standard Review Plan (Section 11.2). Foundations and walls are required to be designed and fabricated to contain the liquid inventory which might be released during a container/tank failure.
- C Facility design and operation should assure that radiological consequences of design basis events (fire, tornado, seismic event, flood) should not exceed a small fraction of 10 CFR Part 100, i.e., no more than a few rem whole body dose. The quantity of radioactive material allowed and the shielding configurations will be dictated by the dose rate criteria for both the site boundary and unrestricted areas on-site.

A.5.4 Intent of NRC Requirements

To ensure that site characteristics are considered in the design, construction, and operation of facilities so as to result in an extremely low probability for accidents that could release significant quantities of radioactive fission products.

A.5.5 Comparison of Intent

The intents of the two programs are equivalent in that under either program, the operation of the facility and waste storage areas is not to be affected by either seismic or flood events. Under the RCRA program, EPA specifically prohibits the siting of a facility within 61 meters (200 feet) of a fault which has had displacement in Holocene time and requires the owner/operator to ensure that wastes will not be washed out of the facility. Whereas, NRC obtains the same level of protection by allowing facilities to be sited in areas where unfavorable physical characteristics exist, so long as the design of the facility includes appropriate and adequate compensating engineering safeguards.

A.6 **REQUIRED AISLE SPACE**

A.6.1 RCRA Requirements

40 CFR 264.35 requires the owner/operator to maintain aisle space to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of facility operation in an emergency, unless it can be demonstrated to the Regional Administrator that aisle space is not needed for any of these purposes.

A.6.2 Intent of RCRA Requirements

To ensure that personnel and emergency responders have sufficient aisle space to allow them to conduct their jobs unconstrained by physical space limitations anywhere in the facility.

A.6.3 NRC Requirements

NRC regulations and requirements related to aisle space are contained in 10 CFR 20.1101, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), Regulatory Guide 1.143, and Inspection Procedure 84900, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures as providing for sufficient aisle space to allow occupationally exposed individuals sufficient work space to conduct their jobs safely.)
- C Radioactive waste management structures, systems, and components should be designed to control leakage and facilitate access, operation, inspection, testing, and maintenance in order to maintain radiation exposures to operating and maintenance personnel ALARA.
- C Surveillance programs are required to incorporate adequate methods for detecting failure or container integrity and measuring releases to the environment. Inspection of container integrity may be performed by walk-throughs if storage facility layout, shielding, and the container storage array permit.
- C Licensees are required to provide adequate access to, and housekeeping around waste packages. Furthermore, adequate visibility should also be provided to permit identification of unsafe conditions and to allow for effective material control and accountability.

A.6.4 Intent of NRC Requirements

To ensure that sufficient space exists for occupationally exposed individuals to be able to both observe waste containers (for integrity and accountability purposes) and to perform housekeeping.

A.6.5 Comparison of Intent

The intents of the two programs are equivalent in that containers must be stored in a manner which permits their inspection and access for maintenance (including repacking). Although the RCRA program specifies that there must be enough aisle space for workers and emergency responders, the NRC program accomplishes the same objective through requiring that the facility be designed and operated in a manner that controls radiation exposure to ALARA. Specifically, in order for emergency responders to control a fire or other event so that radiation exposures are kept to ALARA, they must be able to have sufficient space to conduct their work, which would include sufficient physical space for moving, using, and decontaminating emergency equipment.

A.7 **ARRANGEMENTS WITH LOCAL AUTHORITIES**

A.7.1 RCRA Requirements

40 CFR 264.37(a)-(b) requires the owner/operator to make the following arrangements:

- C Arrangements to familiarize police, fire departments, and emergency response teams with the facility, nature of wastes handled, and other safety considerations.
- C Arrangements designating primary emergency authority.
- C Arrangements with state emergency response teams, emergency response contractors, and equipment suppliers.
- C Arrangements to familiarize local hospitals with the wastes handled and the potential injuries.

In instances where the state or local authorities decline to enter into such arrangements, the owner/operator must document the refusal.

A.7.2 Intent of RCRA Requirements

The intent of the RCRA program is twofold. First, to ensure that emergency responders, who understand the nature of the wastes and hazards posed by the wastes at the site, are available and able to take the necessary precautions to quickly and safely respond to site emergencies. Second, to ensure that injured individuals have access to and receive proper medical attention in a lifesaving (timely) manner.

A.7.3 NRC Requirements

NRC regulations and requirements related to arrangements with local authorities are contained in 10 CFR 20.2203 and 10 CFR 50.47, and include the following:

- C Corrective steps are taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, ALARA constraints, generally applicable environmental standards, and associated license conditions.
- C The NRC reviews site emergency plans to ensure that they include the following standards with offsite aspects: (1) arrangements for requesting and effectively using offsite assistance onsite have been made, arrangements to accommodate state and local staff at the licensee's near-site Emergency Operations Facility have been made, and other organizations capable of augmenting the planned onsite response have been identified; (2) procedures have been established for licensee communications with state and local response organizations, including initial notification of the declaration of emergency and periodic provision of plant and response status reports; (3) provisions exist for prompt communications among principal response organizations to offsite emergency personnel who would be responding onsite; (4) adequate emergency facilities and equipment to support the emergency response onsite are provided and maintained; (5) adequate methods, systems, and equipment for assessing and monitoring actual or potential offsite consequences of a radiological emergency condition are in use onsite; (6) arrangements are made for medical services for contaminated and injured onsite individuals; and (7) radiological emergency response training has been made available to those offsite who may be called to assist in an emergency onsite.
- C Management Directive 8.6 - "*Systematic Assessment of Licensee Performance (SALP)*." This document explains how the NRC uses the Systematic Assessment of Licensee Performance (SALP) process to articulate the agency's observations and insights on the licensee's safety performance. The SALP report communicates those observations and insights to licensee management and the public. (Note: this program was recently discontinued and is being replaced by a new program entitled "The Regulatory Oversight Process." This new program began testing in June 1999 and should be implemented in early 2000.)
- C Licensees shall also commit to notify the NRC operations center immediately after notification of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency.

A.7.4 Intent of NRC Requirements

To ensure that (1) there is reasonable assurance that adequate protective measures can and will be taken in the event of radiological (or other) emergency through coordination with the Federal Emergency Management Agency (FEMA), state, and local authorities; (2) emergency responders, who understand the nature of the wastes and hazards posed by the wastes at the site, are available and able to take the necessary precautions to quickly and safely respond to site emergencies; and (3) both injured occupationally exposed individuals and members of the general public have access to and receive proper medical attention in a lifesaving (timely) manner.

A.7.5 Comparison of Intent

The intents of the two programs are equivalent in that they require facilities to ensure that (1) emergency responders are both trained and have access to necessary equipment to safely respond to facility emergencies, (2) lines of communications and assigned responsibilities are established, and (3) appropriate medical services are available.

A.8 **RECORD KEEPING REQUIREMENTS**

A.8.1 RCRA Requirements

40 CFR 264.73(a-b) requires that the owner/operator maintain a written operating record and that the operating record must document the description and quantity of wastes handled, the location of each waste within the facility, records of all incidents that require implementation of the contingency plan, and details of closure cost estimates and, post-closure cost estimates (for disposal facilities).

In addition, 40 CFR 264.74(a-b) requires that the owner/operator furnish all records upon request by the EPA, and also submit a copy of records of waste disposal locations under 40 CFR 264.73 (b)(2) to the Regional Administrator and local land authority upon closure of the facility.

A.8.2 Intent of RCRA Requirements

To ensure that facilities (1) maintain accurate records of how much and where wastes are managed onsite, and (2) can safely operate their facility by knowing about all incidents that required implementation of the site's contingency plan so that they can incorporate "lessons learned" into updated operating procedures and contingency plans.

A.8.3 NRC Requirements

NRC regulations and requirements related to record keeping for waste disposal (and closure/post-closure cost estimates) are contained in 10 CFR 20 Subpart L, 10 CFR 20 (Appendix G), 10 CFR 50.75(f)(1), Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedures 84101, 84850, 84900, 86750, and 88035, and include the following:

- C Each licensee shall maintain records of doses received by all individuals for whom monitoring was required, and records of doses received during planned special exposures, accidents, and emergency conditions. In addition, a waste generator, collector, or processor who transports, or offers for transportation, low-level radioactive waste intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility must prepare a Manifest reflecting information requested on applicable NRC forms 540 and 541, and if necessary, on an applicable NRC form 542. NRC forms 540 and 540A must be completed and must physically accompany the pertinent low-level waste shipment.
- C Each commercial power licensee is required to submit a preliminary decommissioning cost estimate to NRC at, or about 5 years prior to the projected end of operations.
- C For low level dry waste and solidified waste storage, the licensee is required to maintain inventory records of waste types, contents, dates of storage and shipment.
- C NRC Inspectors determine whether the licensee has established and maintained adequate management-controlled procedures and quality assurance that reasonably ensure compliance with the requirements of 10 CFR Part 20 and 10 CFR Part 61 applicable to low-level radioactive waste

(radwaste) form, classification, stabilization, and shipment manifests/tracking. With regard to the storage and disposal of radioactive solid waste, the inspector has to determine whether the licensee has followed the procedures and regulatory requirements for proper classification and characterization of wastes, for preparation of waste manifests, for marking packages with the class of waste, and for investigation of lost shipments. Inspectors also determine: (1) whether the licensee has any special authorizations and requirements for LLW storage; (2) where LLW is being stored; (3) how long the LLW has been stored and examine the licensee's accountability and security procedures for the waste; (4) that the licensee has conducted and properly documented inspections of LLW packages, radiation surveys of individual packages and the storage area, and any required effluent sampling; (5) whether the licensee's records for waste placed in storage are adequate and that LLW is accounted for; and (6) whether the licensee has incorporated the results of "lessons learned," as a result of any violations and corresponding corrective action which may have occurred since the last inspection, into lesson plans for employees who operate low-level waste processing equipment or for occupationally exposed individuals involved in the transfer and packaging of radioactive material.

A.8.4 Intent of NRC Requirements

To ensure that facilities (1) maintain accurate records of how much and where wastes are managed onsite, (2) maintain records of the radiation exposures received by occupationally exposed individuals and visitors, and (3) can safely operate their facility by knowing about all incidents that required implementation of the site's contingency plan so that they can incorporate "lessons learned" into updated operating procedures and contingency plans.

A.8.5 Comparison of Intents

The intents of the two programs are equivalent in that they both require (1) accurate record keeping of the types and volumes of wastes managed at the facility, and (2) that information gained by the facility in responding to previous events is incorporated into an updated contingency plan so that the facility can be in a better position to prevent/respond to future events. It should be noted that although RCRA stipulates that details of closure and post-closure cost estimates be kept in the site's operating record, the NRC requires the licensee to submit a preliminary decommissioning cost estimate to NRC at, or about 5 years prior to the projected end of operations. This difference, however, does not affect the site's ability to safely manage LLW (NRC's requires this information to be recorded elsewhere, such as the FSAR).

A.9 **REPORTING REQUIREMENTS**

A.9.1 RCRA Requirements

40 CFR 264.75(a-e) requires that the owner/operator submit a single copy of a biennial report to the Regional Administrator by March 1 of each even numbered year (submitted on EPA form 8700-13B). The report must include the name and address of the facility, type of waste handled by the facility, method of treatment, storage or disposal, closure cost and post-closure cost estimates (for disposal facilities) and, for off-site facilities, the EPA identification number of each hazardous waste generator from which the facility received a hazardous waste during the year.

A.9.2 Intent of RCRA Requirements

The intent of the RCRA program is to enable EPA to both maintain a tracking/accounting system of hazardous waste activities taking place at facilities throughout the country and study waste generation rates, handling procedures, treatment practices, disposal trends, and other issues (such as measuring progress in pollution prevention).

A.9.3 NRC Requirements

NRC regulations and requirements related to reporting are contained in 10 CFR 20 Subpart M (Appendix F and Appendix G), Generic Letter #81-38 (Enclosure), and Inspection Procedures 84101 and 88035, and include the following:

- C A waste generator, collector, or processor who transports, or offers for transportation, low-level radioactive waste intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility must prepare a Manifest reflecting information requested on applicable NRC forms 540 and 541, and if necessary, on an applicable NRC form 542. NRC forms 540 and 540A must be completed and must physically accompany the pertinent low-level waste shipment.
- C The inspector is required to determine the licensee's compliance with the following listed regulations and/or license requirements applicable to the facility: (1) 10 CFR 40.65 and 10 CFR 50.36(a) [effluent reporting requirements]; (2) license requirements for effluent reports, in terms of frequency and content, and maintenance of records; (3) license requirements for reports of solid waste in storage. The inspector also has to determine whether the licensee has followed the procedures and regulatory requirements for proper classification and characterization of wastes, for preparation of waste manifests, for marking packages with the class of waste, and for investigation of lost shipments.
- C Under Management Directive 8.6, NRC undertakes a "Systematic Assessment of Licensee's Performance" to provide a method for informing the public of the NRC's assessment of licensee performance. (Note: this program was recently discontinued and is being replaced by a new program entitled "The Regulatory Oversight Process." This new program began testing in June 1999 and should be implemented in early 2000.)

A.9.4 Intent of NRC Requirements

To ensure that a paper trail documenting the ultimate disposition of LLW is created.

A.9.5 Comparison of Intents

With one exception, the intents of the two programs are equivalent in that both systems require facilities to create a paper trail to document the ultimate disposition of waste (from "cradle to grave") by using waste manifests that also provide the information required by the Department of Transportation (DOT). The one exception between the two programs is that the NRC does not require facilities to submit biennial reports. The lack of such "administrative" reporting, however, does not affect the storage of waste at the facility and NRC has other procedures for monitoring waste generation and management trends (including pollution prevention), such as having resident inspectors onsite at every operating facility that can both observe operations and review operating records detailing types and volumes of waste stored onsite.

A.10 **CONDITION OF CONTAINERS**

A.10.1 RCRA Requirements

40 CFR 264.171 stipulates that if a container holding hazardous waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak, the owner/operator must transfer the hazardous waste from this container to a container that is in good condition or manage the waste in some other way that complies with the requirements of this part.

A.10.2 Intent of RCRA Requirements

To ensure that container integrity is maintained and to minimize threat to either human health or the environment from releases of hazardous waste.

A.10.3 NRC Requirements

NRC regulations and requirements related to the conditions of containers are found in 10 CFR 20, 10 CFR 50 (Appendix A), Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedures 84900 and 86750, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures as inspecting containers and determining that they do not pose a risk.)
- C Potential release pathways of all radionuclides present in the solidified waste form should be monitored. Surveillance programs shall incorporate adequate methods for detecting failure of container integrity and measuring releases to the environment. Monitoring shall be conducted to insure that levels are below limits specified in 10 CFR Part 20. All containers should be decontaminated to these levels.
- C Licensees shall monitor the external surfaces of packages (i.e., containers) for radiation and if there is evidence of degradation of package integrity.
- C Appropriate systems shall be provided in fuel storage and radioactive waste systems and associated handling areas to (1) detect conditions that may result in loss of residual heat removal capability and excessive radiation levels and (2) initiate appropriate safety actions.
- C Provision should be made by the licensee for additional reprocessing or repackaging due to container failure and/or, as required for final transporting and burial as per DOT and burial site criteria. Contamination isolation and decontamination capabilities should also be developed. When significant handling and personnel exposure can be anticipated, ALARA methodology should be incorporated as per Regulatory Guides 8.8 and 8.10.
- C NRC inspectors are required to assess if the licensee has provided management approved, detailed instructions and operating procedures for all occupationally exposed individuals involved in the transfer, packaging, and transport of low-level radioactive waste with special attention given to controls on the chemical and physical form of the radioactive material and on the containment integrity of the packaging. The inspectors also are required to examine the adequacy of the storage area to assure its adequacy with regard to package integrity and labeling.

A.10.4 Intent of NRC Requirements

To ensure that container integrity is maintained and to minimize threat to either human health or the environment from releases of LLW.

A.10.5 Comparison of Intents

The intents of the two programs are equivalent in that both programs require facilities to maintain container integrity and to mitigate container failure through repackaging.

A.11 COMPATIBILITY OF WASTE WITH CONTAINERS

A.11.1 RCRA Requirements

40 CFR 264.172 requires that the owner/operator must use a container made of, or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired.

A.11.2 Intent of RCRA Requirements

To ensure that container integrity is maintained by placing only wastes that are compatible with the container material in the waste container.

A.11.3 NRC Requirements

NRC regulations and requirements related to the compatibility of waste with containers are found in 10 CFR 20.1101, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedure 84900, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable. (This requirement would include such operating procedures as ensuring that wastes are compatible with the container.)
- C Compatibility of the container materials with the waste forms and with environmental conditions external to the containers is required to prevent significant container corrosion. Container selection should be based on data which demonstrates minimal corrosion from the anticipated internal and external environment for a period well in excess of the planned storage duration. Container integrity after the period of storage should be sufficient to allow handling during transportation and disposal without container breach.
- C If liquids exist which are corrosive, proven provisions should be made by the licensee to protect the container (i.e., special liners or coatings) and/or neutralize the excess liquids. If deemed appropriate and necessary, highly non-corrosive materials (e.g., stainless steel) should be used. Potential corrosion between the solid waste forms and the container should also be considered. The Process Control Program (PCP) should implement steps to assure the above does not occur; provisions on container material selection and precoating should be made to insure that container breach does not occur during temporary storage periods.
- C For low level and solidified waste storage, licensees are required to ensure that container integrity should be assured against corrosion from the external environment and external weather protection should be included where necessary and practical. Storage containers should be raised off storage pads where water accumulation can be expected to cause external corrosion and possible degradation of container integrity. In the case of wet radioactive waste storage, all tanks and containers should be designed to withstand the corrosive nature of the wet waste stored while taking into account the duration of storage under which the corrosive conditions exist.
- C Licensees are required to ensure that casks, tanks, and liners containing solidified radioactive waste are designed with good engineering judgment to preclude or reduce the probability of occurrence of uncontrolled releases of radioactive materials due to handling, transportation, or storage. Furthermore, accident mitigation and control for design basis events (e.g., fire, flooding, tornadoes etc.) must be evaluated and protected against unless otherwise justified. Waste containers should be designed to insure radioactive material containment during normal and material occurrences and

both the waste container materials should not support combustion and the packaged materials should not cause fires through spontaneous chemical reactions, retained heat, etc.

- C Dewatered resins and filter media with radioactivity levels above 1uCi/cc (0.5yr, half life) which are disposed of on or after July 19, 1981, will be required to be stored in high integrity containers (e.g., reinforced concrete). Any storage plans should address container protection as well as reprocessing requirements for eventual shipment and burial.
- C Licensees should ensure that containers comply with the criteria of 10 CFR 71 and 49 CFR 170 to minimize the need for repackaging for shipment.
- C NRC inspectors are required to examine the adequacy of the storage area to assure its adequacy with regard to package integrity and labeling.

A.11.4 Intent of NRC Requirements

To ensure that container integrity is maintained by placing only wastes that are compatible with the container material in the waste container.

A.11.5 Comparison of Intent

The intents of the two programs are equivalent in that both programs promote container integrity by requiring facilities to consider the characteristics of the wastes to be containerized when selecting appropriate containers.

A.12 MANAGEMENT OF CONTAINERS

A.12.1 RCRA Requirements

40 CFR 264.173(a) requires the owner/operator to ensure that a container holding hazardous waste must always be closed during storage, except when adding or removing waste. In addition, 40 CFR 264.173(b) requires that the owner/operator ensure that the container holding hazardous waste must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.

A.12.2 Intent of RCRA Requirements

To protect human health and the environment by ensuring that waste containers are managed in a manner that reduces the risk of releases to either the air or ground.

A.12.3 NRC Requirements

NRC regulations and requirements related to the management of containers are found in 10 CFR 20.1101, 10 CFR 50.34, 10 CFR 50.36, and 10 CFR 50 (Appendix A), Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedures 84101, 84850, 84900, and 88035, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering controls necessary to ensure that occupationally exposed individuals are not at risk from releases resulting from mismanaged containers.)
- C The licensee also is required to provide a general description of the provisions for packaging, storage, and shipment offsite of solid waste containing radioactive materials resulting from treatment of gaseous and liquid effluents and from other sources in its license application.
- C The fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. In addition, radioactive waste management structures, systems, and components should be designed to facilitate access, operation, inspection, and testing in order to maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable.
- C Potential release pathways of all radionuclides present in the solidified waste form should be monitored. Surveillance programs shall incorporate adequate methods for detecting failure of container integrity and measuring releases to the environment. Monitoring shall be conducted to insure that levels are below limits specified in 10 CFR Part 20.
- C The Process Control Program (PCP) implemented by the licensee should ensure that corrosion between the solid waste forms and the container does not occur; provisions on container material selection and precoating should be made to insure that container breach does not occur during temporary storage periods; and standard operating procedures for safely handling waste containers.
- C For low level and solidified waste storage, licensees are required to ensure that container integrity should be assured against corrosion from the external environment and external weather protection should be included where necessary and practical. Storage containers should be raised off storage pads where water accumulation can be expected to cause external corrosion and possible degradation of container integrity. In the case of wet radioactive waste storage, all tanks and

containers should be designed to withstand the corrosive nature of the wet waste stored while taking into account the duration of storage under which the corrosive conditions exist. Licensees are required to ensure that low level solidified waste stored in outside areas should be held securely by installed hold down systems. The hold down system should secure all containers during severe environmental conditions up to and including the design basis event for this waste storage facility.

- C Any storage plans should address container protection as well as any reprocessing for eventual shipment and burial.
- C Licensees are required to implement controls to segregate and minimize the generation of low-level dry waste to lessen the impact on waste storage.
- C Provision should be made by the licensee for additional reprocessing or repackaging due to container failure and/or, as required for final transporting and burial as per DOT and burial site criteria. Contamination isolation and decontamination capabilities should also be developed. When significant handling and personnel exposure can be anticipated, ALARA methodology should be incorporated as per Regulatory Guides 8.8, 8.10 (Revision 1), 8.18 (Revision 1), and 8.37.
- C The quantity of radioactive material allowed and the shielding configurations will be dictated by the dose rate criteria for both the site boundary and unrestricted areas on-site, and the total curie limits for the facility should be established based on the design of the storage area and the safety features provided. The 40 CFR 190 limits will restrict the annual dose from direct radiation and effluent release to the Public (individual) to less than 25 mrem per year to the whole body from all sources of the Uranium fuel cycle; therefore, off-site doses from on-site storage must be sufficiently low to account for other sources. On-site dose limits associated with temporary storage will be controlled per 10 CFR Part 20, including the ALARA principle of 10 CFR 20.1003. The same standards apply for liquid radioactive waste storage, solidified radioactive waste storage, and for low level dry waste storage.
- C In order to determine whether fuel cycles and materials licensees who store low-level radioactive waste (LLW) are doing so safely and in accordance with license conditions, NRC inspectors are required to review: (1) the license file and identify any special authorizations and requirements for LLW storage; (2) how long the LLW has been stored and examine the licensee's accountability and security procedures for the waste; (3) whether the licensee is in compliance with possession limits; (4) the licensee's procedures for safe placement, inspection and repackaging of LLW in storage; (5) documentation of inspections of LLW packages to assure they maintain integrity; radiation surveys of individual packages and the storage area, in general, and any required effluent sampling; and (6) the licensee's records for waste placed in storage and assure that they are adequate and that LLW is accounted for. NRC Inspectors also are required to check the storage area to ensure that it is adequately protected from environmental elements, fire and flooding, temperature/humidity extremes, and ventilation considerations.

A.12.4 Intent of NRC Requirements

To ensure that licensees both (1) incorporate engineered features into the design of their waste storage areas and waste containers, and (2) develop standard operating procedures for handling and managing waste containers to ensure that radiation exposures are kept to ALARA under typical and postulated accident conditions.

A.12.5 Comparison of Intent

The intents of the two programs are equivalent as both programs protect human health and the environment by ensuring that waste containers are managed in a manner that reduces the risk of releases to either the air or ground. Although the RCRA program specifically states that containers must always be closed during storage, except when adding or removing waste, the NRC obtains the same result by requiring licensees to limit radiation releases to ALARA. Specifically, waste container lids are part of the engineering design of the waste containment system, and the waste container must be sealed if the licensee is to control radiation releases to ALARA.

A.13 CONTAINMENT (LIQUIDS)

A.13.1 RCRA Requirements

40 CFR 264.175 (a)-(b) stipulates specific containment provisions for container storage areas holding liquid hazardous waste, as follows:

- C A base must underlie the containers which is free of cracks or gaps and is sufficiently impervious to contain leaks, spills and accumulated precipitation until the collected material is detected and removed.
- C The base must be sloped or the containment system must be otherwise designed and operated to drain and remove liquids resulting from leaks, spills, or precipitation, unless the containers are elevated or are otherwise protected from contact with accumulated liquids.
- C The containment system must have sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater.
- C Run-on into the containment system must be prevented unless the collection system has sufficient excess capacity to contain any run-on that might enter into the system.
- C Spilled or leaked waste and accumulated precipitation must be removed from the sump or collection area in as timely a manner as is necessary to prevent overflow of the collection system.

A.13.2 Intent of RCRA Requirements

To ensure that storage areas are designed to prevent liquid wastes (or mixtures of waste/precipitation) from either overflowing (or leaking from) the storage facility's containment system, or remaining in direct contact with the waste containers in the storage facility.

A.13.3 NRC Requirements

NRC regulations and requirements related to the containment of liquids are contained in 10 CFR 50 (Appendix A), Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedure 84100, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such engineering controls necessary to contain a spill to reduce and/or prevent exposure of radioactive materials to occupationally exposed individuals.)
- C Licensees are required to provide protection to insure the radioactivity is contained safely by use of good engineering judgment, such as the use of curbs and drains to contain spills of dewatered resins or sludges. Structures that house liquid radwaste storage tanks are required to be designed according to seismic criteria defined in NRC's Standard Review Plan (Section 11.2). Foundations and walls are also required to be designed and fabricated to contain the liquid inventory which might be released during a container/tank failure.
- C All storage structures should have curbs or elevated thresholds with floor drains and sumps to safely collect wet waste assuming the failure of all tanks or containers. Furthermore, provisions should be incorporated to remove spilled wet waste to the radwaste treatment systems. Licensees also are required to make provisions for collecting liquid drainage including provisions for sampling all collected liquids. Routing of the collected liquids should be to radwaste systems if contamination is detected or to normal discharge pathways if the water ingress is from external sources and remains uncontaminated.
- C For low level and solidified waste storage, licensees are required to ensure that container integrity should be assured against corrosion from the external environment and external weather protection should be included where necessary and practical. Storage containers should be raised off storage pads where water accumulation can be expected to cause external corrosion and possible degradation of container integrity.
- C NRC inspectors are required to determine compliance with effluent requirements and efforts to keep effluents ALARA. In addition, he also has to determine by observation whether the liquid waste systems incorporate provisions to prevent and collect leakage, overflows, and spillage in accordance with the licensee approved safety analysis report.

A.13.4 Intent of NRC Requirements

To ensure that (1) storage areas are designed to prevent liquid wastes (or mixtures of waste/precipitation) from either overflowing the storage facility's containment system, or remaining in direct contact with the waste containers in the storage facility, and (2) collected liquids are monitored and treated accordingly.

A.13.5 Comparison of Intents

The intents of the two programs are equivalent in that storage areas must be designed to both contain liquid wastes (or mixtures of waste and precipitation) and minimize contact with waste containers in the storage area. We note that the NRC requires that all storage areas have curbs or elevated thresholds with floor drains and sumps to safely collect wet waste assuming the failure of all tanks or containers, whereas the RCRA program requires containment of either 10% of the volume of all containers or 100% of the largest single container (whichever is larger) plus any collected runoff (if an outdoors storage area). In addition,

although the RCRA program specifically states that the base of the storage area must be sufficiently impervious to prevent liquid from leaking until the liquid is detected and removed, NRC obtains the same performance goal without making the same statement an explicit requirement. Specifically, NRC requires storage areas to contain liquid wastes, which includes preventing liquids from leaking through the base of the storage area (NRC inspectors check to see whether the liquid waste systems incorporate provisions to prevent and collect leakage, overflows, and spillage).

A.14 CONTAINMENT (NON-LIQUIDS)

A.14.1 RCRA Requirements

40 CFR 264.175(c) stipulates that storage areas that store containers holding only wastes that do not contain free liquids need not have a containment system provided that:

- C The storage area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation.
- C The containers are elevated or are otherwise protected from contact with accumulated liquid.

A.14.2 Intent of RCRA Requirements

To ensure that storage containers do not remain in direct contact with precipitation collecting in the storage area.

A.14.3 NRC Requirements

NRC regulations and requirements related to the containment of non-liquids are found in 10 CFR 20.1101, 10 CFR 50.34, 10 CFR 50 (Appendix A), Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedures 65051 and 84722, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA). (This requirement would include such operating procedures as ensuring that container integrity is unaffected by corrosion resulting from direct contact with precipitation.)
- C Licensees are required to provide protection to ensure the radioactivity is contained safely by use of good engineering judgment, such as the use of curbs and drains to contain spills of dewatered resins or sludges. Licensees are also required to provide general description of the provisions for packaging, storage, and shipment offsite of solid waste containing radioactive materials resulting from treatment of gaseous and liquid effluents and from other sources in their license applications.
- C Potential release pathways of all radionuclides present in the solidified waste form should be monitored. Surveillance programs shall incorporate adequate methods for detecting failure of container integrity and measuring releases to the environment. Monitoring shall be conducted to insure that levels are below limits specified in 10 CFR Part 20. All containers should be decontaminated to these levels.
- C For low level and solidified waste storage, licensees are required to ensure that container integrity should be assured against corrosion from the external environment and external weather protection should be included where necessary and practical. Storage containers should be raised off storage

pads where water accumulation can be expected to cause external corrosion and possible degradation of container integrity.

- C The Process Control Program (PCP) implemented by the licensee should ensure that corrosion between the solid waste forms and the container does not occur; provisions on container material selection and precoating should be made to insure that container breach does not occur during temporary storage periods.
- C Dewatered resins and filter media with radioactivity levels above 1 uCi/cc (0.5yr, half life) which are disposed of on or after July 19, 1981, are required to be stored in high integrity containers (e.g., reinforced concrete). Any storage plans should address container protection as well as reprocessing requirements for eventual shipment and burial.
- C Licensees are required to implement controls to segregate and minimize the generation of low-level dry waste to lessen the impact on waste storage.
- C NRC inspectors are required to determine whether the processing, control, and storage of solid wastes are both adequate and in accordance with the license procedures, safety analysis, Technical Specifications, and applicable federal and state regulations.

A.14.4 Intent of NRC Requirements

To ensure that the potential release pathways of all radionuclides present in the solidified waste form are controlled and that storage containers do not remain in direct contact with precipitation collecting in the storage area.

A.14.5 Comparison of Intents

The intents of the two programs are equivalent in that under both programs facilities are required to ensure that storage containers do not remain in direct contact with precipitation collecting in the storage area through incorporation of design features to either drain collected precipitation or elevate waste containers.

A.15 SPECIAL REQUIREMENTS FOR IGNITABLE OR REACTIVE WASTE

A.15.1 RCRA Requirements

40 CFR 264.176 requires that containers holding ignitable or reactive waste must be located at least 15 meters (50 feet) from the facility's property line.

A.15.2 Intent of RCRA Requirements

The intent of the RCRA requirements are twofold. First, to ensure that containers holding ignitable or reactive wastes are protected from off-site influences beyond the facility's control that could potentially promote a dangerous interaction with the stored wastes. Second, to ensure that members of the general public are protected from any releases or dangerous conditions caused by the accidental ignition or reaction of waste materials within the storage area.

A.15.3 NRC Requirements

NRC regulations and requirements related to ignitable or reactive wastes are contained in 10 CFR 20.1101, 10 CFR 100, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), Standard Review Plan, and Inspection Procedure 84900, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to prevent and/or mitigate dangerous conditions or accidental ignition/reaction of waste materials within a storage area.)
- C The nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military and chemical facilities) must be evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low.
- C In order to minimize the number of potential problems as a result of gas generation from organic materials in waste containers; the waste form; and gas generation rates from radiolysis, biodegradation, or chemical reaction is required to be evaluated with respect to container breach and the creation of flammable/explosive conditions. Unless storage containers are equipped with special vent designs which allow depressurization and do not permit the migration of radioactive materials, resins highly loaded with radioactive material, such as BWR reactor water cleanup system resins, should not be stored for a period in excess of approximately one year.
- C If liquids exist which are corrosive, proven provisions should be made by the licensee to protect the container (i.e., special liners or coatings) and/or neutralize the excess liquids. If deemed appropriate and necessary, highly non-corrosive materials (e.g., stainless steel) should be used. Potential corrosion between the solid waste forms and the container should also be considered. The Process Control Program (PCP) should implement steps to assure the above does not occur; provisions on container material selection and precoating should be made to insure that container breach does not occur during temporary storage periods.
- C With regard to solidified waste storage containers, licensees are required to develop procedures for early detection, prevention and mitigation of accidents (e.g., fires). In addition, storage areas and facility designs should incorporate good engineering features and capabilities for contingencies so as to handle accidents and provide safeguard systems such as fire detectors and suppression systems, (e.g., smoke detectors and sprinklers). Personnel training and administrative procedures should be established to insure both control of radioactive materials and minimum personnel exposures.
- C The quantity of radioactive material allowed and the shielding configurations will be dictated by the dose rate criteria for both the site boundary and unrestricted areas on-site. The 40 CFR 190 limits will restrict the annual dose from direct radiation and effluent release to the public (individual) to less than 25 mrem per year to the whole body from all sources of the uranium fuel cycle; therefore,

off-site doses from on-site storage must be sufficiently low to account for other sources. On-site dose limits associated with temporary storage will be controlled per 10 CFR Part 20 including the ALARA principle of 10 CFR 20.1. The same standards apply for liquid radioactive waste storage, solidified radioactive waste storage, and for low level dry waste storage.

- C Licensees are required to both incorporate design features to preclude the possibility of an explosion if the potential for explosive mixtures exists, and implement controls to segregate and minimize the generation of low-level dry waste to lessen the impact on waste storage.
- C NRC inspectors evaluate low-level radioactive waste storage areas to determine whether licensees are managing low-level wastes safely and in accordance with license conditions.

A.15.4 Intent of NRC Requirements

To ensure that licensees (1) incorporate engineering designs which account for the properties of the waste to preclude the potential for an explosion, and (2) implement operating procedures and controls to prevent and mitigate accidents.

A.15.5 Comparison of Intents

The intents of the two programs are equivalent in that both programs require facilities to implement adequate safeguards to ensure that ignitable and reactive wastes are safely managed. However, under the RCRA program, facilities are required to keep ignitable and reactive wastes a minimum distance from the facility boundary, whereas NRC requires licensees to prevent potential interactions with off-site factors through incorporating engineering design features and effective operating procedures.

A.16 SPECIAL REQUIREMENTS FOR INCOMPATIBLE WASTES

A.16.1 RCRA Requirements

40 CFR 264.177 establishes the following requirements:

- C Prohibits incompatible wastes, or incompatible wastes and materials, from being placed in the same container.
- C Prohibits hazardous wastes from being placed in an unwashed container that previously held an incompatible waste or material.
- C Requires that a storage container holding a hazardous waste that is incompatible with any waste or other materials stored nearby in other containers, piles, open tanks, or surface impoundments be separated from the other materials or protected from them by means of a dike, berm, wall or other device.

A.16.2 Intent of RCRA Requirements

To prevent hazardous reactions from occurring through either the direct contact/mixing of incompatible materials in a waste container or the incidental contact of incompatible materials from leaking containers.

A.16.3 NRC Requirements

While NRC does not have specific regulations related to incompatible wastes, NRC regulations and requirements contained in 10 CFR 20.1101, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), Standard Review Plan, and Inspection Procedure 84900 may be applicable, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to prevent and/or mitigate dangerous conditions resulting from the accidental ignition/reaction of incompatible waste materials within a container.)
- C The acceptance criteria of any proposed storage facility or area will need to meet minimal requirements in areas of design, operations, safety considerations and policy considerations. The major emphasis will be on safety considerations in the storing, handling and eventual disposition of the radioactive waste.
- C Procedures should be developed and implemented for early detection, prevention, and mitigation of accidents (e.g., fires). Storage areas and facility designs should incorporate good engineering features and capabilities for contingencies so as to handle accidents and provide safeguard systems such as fire detectors and suppression systems, (e.g., smoke detectors and sprinklers).
- C Licensees are required to design features to preclude the possibility of an explosion if the potential for explosive mixtures exists.
- C Licensees are required to implement controls to segregate and minimize the generation of low-level dry waste to lessen the impact on waste storage.
- C If liquids exist which are corrosive, proven provisions should be made by the licensee to protect the container (i.e., special liners or coatings) and/or neutralize the excess liquids. If deemed appropriate and necessary, highly non-corrosive materials (e.g., stainless steel) should be used. Potential corrosion between the solid waste forms and the container should also be considered. The Process Control Program (PCP) should implement steps to assure the above does not occur; provisions on container material selection and precoating should be made to insure that container breach does not occur during temporary storage periods.
- C NRC inspectors evaluate low-level radioactive waste storage areas to determine whether licensees are managing low-level wastes safely and in accordance with license conditions. Inspectors are required to inspect the storage area(s) to assure its adequacy with respect to protection from fire and flooding, environmental elements, avoidance of temperature/humidity extremes, ventilation considerations, and package integrity and labeling.

A.16.4 Intent of NRC Requirements

To ensure that licensees (1) incorporate engineering designs which account for the properties of the waste to preclude the potential for an explosion (or dangerous reaction), and (2) implement operating procedures and controls to prevent and mitigate accidents.

A.16.5 Comparison of Intents

The intents of the two programs are equivalent in that both programs require facilities to implement adequate safeguards to ensure that incompatible wastes are safely managed. However, under the RCRA program, facilities are specifically instructed not to mix incompatible materials (or residues) and to maintain a system for the physical separation of incompatible materials, whereas NRC requires licensees to prevent potential interactions through the incorporation of engineering design features and effective operating procedures. Licensees also are subject to the hazard identification and worker safety provisions established by OSHA and are prohibited from mixing incompatible wastes (or materials) in waste containers subject to DOT requirements (e.g., LLW drums that will be transported to an off-site LLW storage or disposal facility).

A.17 CLOSURE

A.17.1 RCRA Requirements

40 CFR 264.178 requires that all hazardous waste and hazardous waste residues be removed from the containment system at closure. In addition, remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residue must be decontaminated or removed.

A.17.2 Intent of RCRA Requirements

To ensure that facilities do not pose a threat to human health or the environment after operations at the facility have ceased by requiring the removal of all hazardous wastes, residues, and contaminated materials (including liners, soils, etc.) from the non-disposal portions of the site.

A.17.3 NRC Requirements

NRC regulations and requirements related to decommissioning are contained in 10 CFR 20.1101, 10 CFR 20.1401-6, 10 CFR 61, Generic Letter #80-051 (Enclosure), and Generic Letter #81-38 (Enclosure), and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such engineering controls necessary to keep exposure to the public ALARA.)
- C A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are ALARA. Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.
- C Applicants for licenses, other than renewals, after August 20, 1997, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable,

contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

- C Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in specific performance objectives.
- C A licensee's disposal site, disposal design, land disposal facility operations (including equipment, facilities, and procedures), disposal site closure, and postclosure institutional control must be adequate to protect the public health and safety in that they provide reasonable assurance that the general population will be protected from releases of radioactivity, inadvertent intrusion, and that long-term stability of the disposed waste and the disposal site will be achieved and will eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure.
- C NRC's Guidance for Onsite Contingency Storage Capacity requires that prior to any implementation of any additional on-site storage, waste management considerations for ALARA, decontamination, and decommissioning of the temporary storage facility, including disposal, should be performed as early as possible because future requirements for waste forms may make stored wastes unacceptable for final disposition.

A.17.4 Intent of NRC Requirements

To ensure that facilities undergo decontamination and decommissioning so that residual radioactivity is reduced to 25 mrem and are ALARA.

A.17.5 Comparison of Intents

The intents of the two programs are very similar in that facilities undergoing closure need to be decontaminated and decommissioned. Under the RCRA program, facilities must remove all RCRA hazardous waste and contaminated components from the non-disposal portions of the facility. However, for a site to be considered acceptable for unrestricted use under the NRC's program, licensees must decontaminate and decommission facilities so that (1) the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem per year (NRC determined that this level was protective of human health and the environment), including that from groundwater sources of drinking water, and (2) the residual radioactivity has been reduced to levels that are ALARA. As such, there is no specific requirement to remove non-radiologically contaminated materials; however, in the process of removing LLMW so that the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem per year, a large portion (if not all) of the RCRA hazardous component of the waste may also be removed. For example, in a typical decontamination process, concrete surfaces undergo scabbling to remove approximately the first inch of the concrete surface, which is where the bulk of radioactive contamination (if present) exists (although deeper portions of the concrete and steel rebar can become activated or contaminated by liquids flowing through expansion joints or cracks in the concrete slab). This physically rigorous removal process should also remove the RCRA hazardous components of the waste (such as organic solvents) that might have been spilled at one time or another, especially since facilities are required to ensure that liquids are drained from storage areas and containment buildings and concrete floors and sumps, etc., are coated to make them impervious.

A.18 DESIGN STANDARDS

A.18.1 RCRA Requirements

40 CFR 264.1101(a) establishes the following design standards for containment buildings:

- C The containment building must be completely enclosed with a floor, walls, and a roof to prevent exposure to the elements (e.g., precipitation, wind, run-on) and to assure containment of managed wastes.
- C The unit must be designed so that it has sufficient structural strength to prevent collapse or other failure. In addition, all surfaces to be in contact with hazardous wastes must be chemically compatible with those wastes. An exception to the structural strength requirement may be made for light weight doors and windows if: (1) they provide an effective barrier against fugitive dust emissions, and (2) the unit is designed and operated in a fashion that assures that wastes will not actually come in contact with these openings.
- C Incompatible hazardous wastes or treatment reagents must not be placed in the unit or its secondary containment system if they could cause the unit or secondary containment system to leak, corrode or otherwise fail.
- C The containment building must have a primary barrier designed to withstand the movement of personnel, waste, and handling equipment in the unit during the operating life of the unit and appropriate for the physical and chemical characteristics of the waste to be managed.

A.18.2 Intent of RCRA Requirements

To ensure that containment buildings are designed and operated in a manner that it is capable of adequately isolating/containing wastes, withstanding environmental elements (e.g., precipitation), and withstanding the wear and tear associated with waste handling activities.

A.18.3 NRC Requirements

NRC regulations and requirements related to design standards for containment buildings are contained in 10 CFR 20.1101, 10 CFR 20.1406, 10 CFR 50.34, 10 CFR 50.36, 10 CFR 50.59, 10 CFR 50 (Appendix A), IE Circular No. 80-18, Regulatory Guide 1.143, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), Standard Review Plan, and Inspection Procedures 65051, 84101, and 84524, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA.
- C Applicants for licenses, other than renewals, after August 20, 1997, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.
- C The fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety and enable monitoring of the effluent discharge paths and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents.
- C NRC prepared Regulatory Guide 1.143 to provide information and criteria that will provide reasonable assurance that components and structures used in the radioactive waste containment, treatment, and management systems are designed, constructed, installed, and tested on a level

commensurate with the need to protect the health and safety of the public and plant operating personnel. It also set forth minimum staff recommendations and was not intended to prohibit the implementation of more rigorous design considerations, codes, standards, or quality assurance measures. A summary of the minimum design criteria set forth by the guide for systems handling radioactive liquids, gases, and solid wastes include the following:

- < **Compatibility.** Construction materials should be compatible with the chemical, physical, and radioactive environment of specific applications during normal conditions and anticipated operational occurrences.
 - < **Structural Design Criteria.** Foundations and walls of structures that house the radwaste systems should be designed to withstand seismic events and be of height sufficient to contain the maximum liquid inventory expected to be in the building.
 - < **Spill Controls.** Radioactive waste management structures, systems, and components should be designed to control leakage and facilitate access, operation, inspection, testing, and maintenance in order to maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable.
- C Storage areas and facility designs should incorporate good engineering features and capabilities for contingencies so as to handle accidents and provide safeguard systems such as fire detectors and suppression systems, (e.g., smoke detectors and sprinklers).
- C Licensees are required to make provisions for collecting liquid drainage including provisions for sampling all collected liquids. Routing of the collected liquids should be to radwaste systems if contamination is detected or to normal discharge pathways if the water ingress is from external sources and remains uncontaminated.
- C Total curie limits for the facility should be established based on the design of the storage area and the safety features provided.
- C Specific design criteria for the liquid radwaste treatment system, including the steam generator, blowdown system, downstream of the outermost containment isolation valve should meet the criteria listed below:
- < Materials in the treatment facility should be compatible with the chemical, physical, and radioactive environment of specific applications during normal conditions and anticipated operational occurrences. If the potential for an explosive mixture of hydrogen and oxygen exists, adequate provisions should be made to preclude buildup of explosive mixtures, or the system should be designed to withstand the effects of an explosion. These requirements apply to and gaseous and solid waste treatment facilities as well.
 - < Foundations and walls of structures that house the liquid radwaste system should be designed to the seismic criteria described by NRC to a height sufficient to contain the maximum liquid inventory expected to be in the building. This requirement applies to solid waste treatment facilities as well.
- C Under the Standard Review Plan, which covers “Liquid Waste Management Systems,” the following areas are reviewed by NRC’s Effluent Treatment System Branch (ETSB):

- < The treatment system design, design objectives, design criteria, methods of treatment, expected releases, and principal parameters used in calculating the releases of radioactive materials in liquid effluents.
 - < Equipment design capacities, expected flow and radionuclide concentrations, expected decontamination factors for radionuclides, and available holdup time.
 - < The system design capacity relative to the design and input flows, and the anticipated period of performance of the system.
 - < The availability of standby equipment, alternative processing routes, and interconnections between subsystems.
 - < Provisions to prevent, control, and collect releases of radioactive material in liquids due to tank overflows.
- C Specific design criteria for the gaseous waste treatment system and those portions of the gaseous radwaste treatment system that are intended to store or delay the release of gaseous radioactive waste, including portions of structures housing these systems, should meet NRC's seismic design criteria. For the systems that normally operate at pressures above 1.5 atmospheres, these criteria should apply to isolation valves, equipment, interconnecting piping, and components located between the upstream and downstream valves used to isolate these components from the rest of the system (e.g., waste gas storage tanks in the PWR) and to the building housing this equipment. For systems that operate near ambient pressure and retain gases on charcoal adsorbers, these criteria should apply to the tank supporting elements (e.g., charcoal delay tanks in a BWR) and the building housing the tanks. In addition, special design features to reduce leakage of gaseous discharge or radioactive materials in gaseous discharge and design features to preclude the possibility of an explosion if the potential for explosive mixtures exists are also required.
- C Specific design criteria for the solid waste treatment facilities, radioactive waste management structures, systems and components should be designed to control leakage and facilitate access, operation, inspection, testing, and maintenance in order to maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable. In addition:
- < Licensees should implement controls to segregate and minimize the generation of low level dry waste to lessen the impact on waste storage. Integration of volume reduction (VR) hardware should be considered to minimize the need for additional waste storage facilities.
 - < While structures are not required to meet seismic criteria, protection should be afforded to insure the radioactivity is contained safely by use of good engineering judgment.
 - < Licensees need to specify the provisions for on-site storage of solid wastes, the expected and design volumes, the expected radionuclide contents, and the design basis for these values. They also need to provide the quality group classifications of piping and equipment, and basis governing the classification chosen.
- C The acceptance criteria of any proposed storage facility, or area will need to meet minimal requirements in areas of design, operations, safety considerations, and policy considerations. The major emphasis will be on safety considerations in the storing, handling, and eventual disposition of the radioactive waste. In addition, it is stipulated in this section that the facility design and operation should assure that radiological consequences of design basis events (fire, tornado, seismic event, flood) should not exceed a small fraction (10%) of 10 CFR Part 100, i.e., no more than a few rem whole body dose.

- C** The quantity of radioactive material allowed and the shielding configurations will be dictated by the dose rate criteria for both the site boundary and unrestricted areas on-site. The 40 CFR 190 limits will restrict the annual dose from direct radiation and effluent release to the Public (individual) to less than 25 mrem per year to the whole body from all sources of the Uranium fuel cycle; therefore, off-site doses from on-site storage must be sufficiently low to account for other sources (e.g., < 1 mrem/year). On-site dose limits associated with temporary storage will be controlled per 10 CFR Part 20 including the ALARA principle of 10 CFR 20.1. The same standards apply for liquid radioactive waste storage, solidified radioactive waste storage, and for low level dry waste storage.
- C** NRC Inspectors are required to (1) determine whether the licensee has provided an adequate safety evaluation for construction and operation of the facility; (2) review changes in equipment, facility, procedures and operations, and determine whether changes are in accordance with 10 CFR 50.59 and license requirements; (3) assess whether the processing, control, and storage of solid wastes are in accordance with the license procedures, safety analysis, and applicable federal and state regulations; and (4) check whether procedures, instrumentation, and equipment to sample and handle radioactive gases and particulates are adequate and operational under accident conditions.

A.18.4 Intent of NRC Requirements

To ensure that licensees incorporate engineering design features and implement procedures to limit exposures to ALARA and minimize contamination of the facility and surrounding environment resulting under both normal operations and postulated accidental events.

A.18.5 Comparison of Intent

The intents of the two programs are equivalent in that both programs require containment buildings to be designed and operated in a manner that it is capable of adequately isolating/containing wastes, withstanding environmental elements (e.g., precipitation), and withstanding the wear and tear associated with waste handling activities. Although the RCRA program specifically states that incompatible wastes or treatment reagents must not be placed in the unit (or the secondary containment system if the material could damage the integrity of the containment system), the NRC's program accomplishes the same performance goal by requiring licensees to prevent potential interactions through the incorporation of engineering design features and effective operating procedures.

A.19 CONTAINMENT (LIQUIDS) AND TREATMENT IN TANKS

In this section we present both the summaries and our analyses of the intent of the RCRA and NRC requirements concerning the containment of liquids and treatment in tanks because of the overlapping requirements associated with the containment of liquids. In addition, summaries and analyses of the programs for (1) handling ignitable, reactive, or incompatible materials, and (2) closure/post-closure are not discussed in this section (see Sections A.4, A.15, A.16, and A.18).

A.19.1 RCRA Requirements

40 CFR 264.1101(b) establishes the following standards for a containment building used to manage hazardous wastes containing free liquids or treated with free liquids:

- C Requires a primary barrier designed and constructed of materials to prevent the migration of hazardous constituents into the barrier (e.g., a geomembrane covered by a concrete wear surface).
- C Requires a liquid collection and removal system to minimize the accumulation of liquid on the primary barrier of the containment building. The primary barrier must be sloped to allow drainage of liquids to the collection system and liquids and wastes must be removed from the containment system at the earliest practicable time to minimize hydraulic head on the containment system.
- C Requires a secondary containment system including a secondary barrier designed and constructed to prevent migration of hazardous waste constituents into the barrier. The secondary barrier has to satisfy certain minimum requirements: (1) it should be constructed with a bottom slope of 1 percent or more; and (2) it should be constructed of a granular drainage material with a hydraulic conductivity of 1×10^{-2} cm/sec or more and a thickness of 12 inches (30.5cm) or more, or constructed of synthetic or geonet drainage materials with a transmissivity of 3×10^{-5} m²/sec or more.
- C Requires that the treatment area within the building be designed to prevent the release of liquids, wet materials, or liquid aerosols to other portions of the building.
- C Establishes that the secondary containment system must be constructed of materials that are chemically resistant to the waste and liquids managed in the containment building and of sufficient strength and thickness to prevent collapse under the pressure exerted by overlying materials and by any equipment used in the containment building.

40 CFR 264.191-196 establishes the following standards for tank systems used to treat hazardous wastes containing free liquids or treated with free liquids:

- C 40 CFR 264.191(a)-(d) requires that the owner operator of a tank system to determine that the tank system is not leaking, is adequately designed, and has sufficient structural strength and compatibility with the waste(s) to be stored or treated, to ensure that it will not collapse, rupture, or fail.

- C 40 CFR 264.192(a)-(g) requires the owner/operator to: (1) obtain a written assessment, reviewed and certified by an independent, qualified registered professional engineer attesting that the tank system has sufficient structural integrity (including corrosion protection) and is acceptable for the storing and treating of hazardous waste; (2) ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation; (3) ensure that tank systems which are placed underground and must be backfilled with a backfill material that is a noncorrosive, porous, homogenous substance and that is installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported; (4) test the tank system for tightness prior to being covered, enclosed, or placed in use; (5) ensure that ancillary equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction; (6) provide the type and degree of corrosion protection recommended by an independent corrosion expert or other corrosion protection if the Regional Administrator believes other corrosion protection is necessary to ensure the integrity of the tank system during use of the tank system; (7) obtain and keep on file at the facility written statements by those persons required to certify the design of the tank system and supervise the installation of the tank system that attest that the tank system was properly designed and installed (and repaired if necessary).
- C 40 CFR 264.193(a)-(f) stipulates that the secondary containment systems must be: (1) designed, installed, and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, ground water, or surface water at any time during the use of the tank system; and (2) capable of detecting and collecting releases and accumulated liquids until the collected material is removed. Secondary containment systems must be at a minimum:
- < Constructed of or lined with materials that are compatible with the waste(s) to be placed in the tank system and must have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which it is exposed, climatic conditions, and the stress of daily operation (including stresses from nearby vehicular traffic).
 - < Placed on a foundation or base capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift.
 - < Provided with a leak-detection system that is designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of hazardous waste or accumulated liquid in the secondary containment system within 24 hours, or at the earliest practicable time if the owner or operator can demonstrate to the Regional Administrator that the existing detection technologies or site conditions will not allow detection of a release within 24 hours.
 - < Sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within 24 hours, or in as timely a manner as is possible to prevent harm to human health and environment, if the owner or operator can demonstrate to the Regional Administrator that removal of the released waste or accumulated precipitation cannot be accomplished within 24 hours.
- C Secondary containment for tanks must include one or more of the following devices: (1) a liner (external to the tank); (2) a vault; (3) a double-walled tank; or (4) an equivalent device as approved by the Regional Administrator.

- C External liner systems must be designed or operated to: (1) contain 100 percent of the capacity of the largest tank within its boundary, and designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration (such additional capacity must be sufficient to contain precipitation from a 25-year, 24-hour rainfall event); (2) be free of cracks or gaps; and (3) surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if the waste is released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the waste).
- C Vault systems must be designed, constructed, or operated to (1) contain 100 percent of the capacity of the largest tank within its boundary; (2) prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration (such additional capacity must be sufficient to contain precipitation from a 25-year, 24-hour rainfall event); (3) have chemically resistant water stops in place at all joints (if any); (4) have an impermeable interior coating or lining that is compatible with the stored waste and that will prevent migration of waste into the concrete; (5) have a means to protect against the formation of and ignition of vapors within the vault, if the waste being stored or treated; (6) have an exterior moisture barrier or be otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure.
- C Double-walled tanks must be: (1) designed as an integral structure (i.e., an inner tank completely enveloped within an outer shell) so that any release from the inner tank is contained by the outer shell; (2) protected, if constructed of metal, from both corrosion of the primary tank interior and of the external surface of the outer shell; and (3) provided with a built-in continuous leak detection system capable of detecting a release within 24 hours, or at the earliest practicable time, if the owner or operator can demonstrate to the Regional Administrator, and the Regional Administrator concludes, that the existing detection technology or site conditions would not allow detection of a release within 24 hours.
- C Some types of ancillary equipment must be provided with secondary containment (e.g., trench, jacketing, double-walled piping)
- C 40 CFR 264.194(a)-(c) stipulates the following general operating requirements for tank system owners/operators: (1) hazardous wastes or treatment reagents must not be placed in a tank system if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, corrode, or otherwise fail; (2) must use appropriate controls and practices to prevent spills and overflows from tank or containment systems, including spill prevention controls (e.g., check valves, dry disconnect couplings), overfill prevention controls (e.g., level sensing devices, high level alarms, automatic feed cutoff, or bypass to a standby tank), and maintenance of sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or by precipitation.
- C 40 CFR 264.195 requires that the owner/operator must develop and follow a schedule and procedure for inspecting overfill controls. The owner or operator also must inspect at least once each operating day: (1) aboveground portions of the tank system, if any, to detect corrosion or releases of waste; (2) data gathered from monitoring and leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design; and (3) the construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g., dikes) to detect erosion or signs of releases of hazardous waste (e.g., wet spots, dead vegetation). Lastly, the owner/operator must inspect cathodic protection systems, if present, according to, at a minimum, the following schedule to ensure that they are functioning properly: (1) the proper operation of the

cathodic protection system must be confirmed within six months after initial installation and annually thereafter, and (2) all sources of impressed current must be inspected and/or tested, as appropriate, at least bimonthly (i.e., every other month).

- C 40 CFR 264.196(a)-(f) requires that the owner/operator must undertake the following activities in response to leaks or spills and disposition of leaking or unfit-for-use tank systems: (1) a tank system or secondary containment system from which there has been a leak or spill, or which is unfit for use, must be removed from service immediately and the owner/operator must immediately stop the flow of hazardous waste into the tank system or secondary containment system and inspect the system to determine the cause of the release; (2) removal of waste from tank system or secondary containment system if the release was from the tank system within 24 hours after detection of the leak or, if the owner/operator demonstrates that it is not possible, at the earliest practicable time, remove as much of the waste as is necessary to prevent further release of hazardous waste to the environment and to allow inspection and repair of the tank system to be performed; (3) immediately conduct a visual inspection of the release and, based upon that inspection both prevent further migration of the leak or spill to soils or surface water; and remove, and properly dispose of, any visible contamination of the soil or surface water.
- C If the owner/operator has repaired a tank system and the repair has been extensive (e.g., installation of an internal liner; repair of a ruptured primary containment or secondary containment vessel), the tank system must not be returned to service unless the owner/operator has obtained a certification by an independent, qualified, registered, professional engineer that the repaired system is capable of handling hazardous wastes without release for the intended life of the system.

A.19.2 Intent of RCRA Requirements

With regard to the containment of liquids, the intent of the RCRA program is to ensure that containment buildings are properly designed with physically and chemically resistant primary and secondary containment systems for both collecting liquids and preventing the migration of liquids, wet wastes, or aerosols from the unit.

With regard to treatment in tanks, the intent of the RCRA program is to ensure that tank systems are well designed, constructed, operated, and maintained so as to prevent the release of liquids or wet wastes from the tank system as a result of overfilling, container failure, or other operational event.

Lastly, the intent of the RCRA program for both the containment of liquids and treatment in tanks is to ensure that frequent monitoring and inspections are performed to (1) prevent, detect, and mitigate releases of liquids resulting from tank failures, (2) remove the tank from service until it can be adequately repaired, (3) remove the collected liquid/wet waste from the tank system and/or secondary containment system within 24 hours of detection (or the earliest practicable time); and (4) report the event within 24 hours of detection.

A.19.3 NRC Requirements

NRC regulations and requirements related to the containment of liquid wastes and treatment in tanks are contained in 10 CFR 20.1101, 10 CFR 50 (Appendix A), Standard Review Plan, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedures 84100 and 84523, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to ensure that liquids are contained.)

- C Specific design criteria for the liquid radwaste treatment system, including the steam generator, blowdown system, downstream of the outermost containment isolation valve should meet the criteria listed below:
- < Materials in the treatment facility should be compatible with the chemical, physical, and radioactive environment of specific applications during normal conditions and anticipated operational occurrences. If the potential for an explosive mixture of hydrogen and oxygen exists, adequate provisions should be made to preclude buildup of explosive mixtures, or the system should be designed to withstand the effects of an explosion. These requirements apply to and gaseous and solid waste treatment facilities as well.
 - < Foundations and walls of structures that house the liquid radwaste system should be designed to the seismic criteria described by NRC to a height sufficient to contain the maximum liquid inventory expected to be in the building. This requirement applies to solid waste treatment facilities as well.
- C Under the Standard Review Plan, which covers "Liquid Waste Management Systems," the following areas are reviewed by NRC's Effluent Treatment System Branch (ETSB):
- < The treatment system design, design objectives, design criteria, methods of treatment, expected releases, and principal parameters used in calculating the releases of radioactive materials in liquid effluents.
 - < Equipment design capacities, expected flow and radionuclide concentrations, expected decontamination factors for radionuclides, and available holdup time.
 - < The system design capacity relative to the design and input flows, and the anticipated period of performance of the system.
 - < The availability of standby equipment, alternative processing routes, and interconnections between subsystems.
 - < Provisions to prevent, control and collect releases of radioactive material in liquids due to tank overflows.
- C Specific design criteria for the gaseous waste treatment system and those portions of the gaseous radwaste treatment system that are intended to store or delay the release of gaseous radioactive waste, including portions of structures housing these systems, should meet NRC's seismic design criteria. For the systems that normally operate at pressures above 1.5 atmospheres, these criteria should apply to isolation valves, equipment, interconnecting piping, and components located between the upstream and downstream valves used to isolate these components from the rest of the system (e.g., waste gas storage tanks in the PWR) and to the building housing this equipment. For systems that operate near ambient pressure and retain gases on charcoal adsorbers, these criteria should apply to the tank supporting elements (e.g., charcoal delay tanks in a BWR) and the building housing the tanks. In addition, special design features to reduce leakage of gaseous discharge or radioactive materials in gaseous discharge and design features to preclude the possibility of an explosion if the potential for explosive mixtures exists are also required.
- C The facility supporting structure and tanks are required to be designed to prevent uncontrolled releases of radioactive materials due to spillage or accident conditions.

- C Structures that house liquid radwaste storage tanks are required to be designed according to seismic criteria defined in NRC's Standard Review Plan (Section 11.2). Foundations and walls are also required to be designed and fabricated to contain the liquid inventory which might be released during a container/tank failure. Materials should be compatible with the chemical, physical, and radioactive environment of specific applications during normal conditions and anticipated operational occurrences. Furthermore, all tanks and containers are required to have provisions to monitor liquid levels and to alarm potential overflow conditions.
- C Specific design criteria for the radioactive waste management structures, systems, and components should be designed to control leakage and facilitate access, operation, inspection, testing, and maintenance in order to maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable.
- C All tanks located outside reactor containment and containing radioactive materials in liquids should be designed to prevent uncontrolled releases of radioactive materials due to spillage in buildings or from outdoor tanks. The following design features should be included for such tanks:
 - < All tanks inside and outside the plant, including the condensate storage tanks, should have provisions to monitor liquid levels. Designated high-liquid-level conditions should actuate alarms both locally and in the control room.
 - < All tank overflows, drains, and sample lines should be routed to the liquid radwaste treatment system.
 - < Indoor tanks should have curbs or elevated thresholds with floor drains routed to the liquid radwaste treatment system.
 - < The design should include provisions to prevent leakage from entering unmonitored and nonradioactive systems and ductwork in the area.
 - < Outdoor tanks should have a dike or retention pond capable of preventing runoff in the event of a tank overflow and should have provisions for sampling collected liquids and routing them to the liquid radwaste treatment systems.
- C Casks, tanks, and liners containing solidified radioactive waste should be designed with good engineering judgment to preclude or reduce the probability of occurrence of uncontrolled releases of radioactive materials due to handling, transportation or storage.
- C While structures are not required to meet seismic criteria, protection should be afforded to insure the radioactivity is contained safely by use of good engineering judgment, such as the use of curbs and drains to contain spills of dewatered resins or sludges.
- C Licensees are required to make provisions for collecting liquid drainage including provisions for sampling all collected liquids. Routing of the collected liquids should be to radwaste systems if contamination is detected or to normal discharge pathways if the water ingress is from external sources and remains uncontaminated.
- C Total curie limits for the facility should be established based on the design of the storage area and the safety features provided.
- C The Process Control Program (PCP) implemented by the licensee should assure that potential corrosion between the solid waste forms and the container does not occur; provisions on container

material selection and precoating should be made to insure that container breach does not occur during temporary storage periods.

- C Licensees are required to provide the following information which NRC reviews for adequacy include:
- < The description of the methods for solidification (i.e., removal of free water), the description of methods for dewatering, the solidifying agent used, and the implementation of a process control program to ensure a solid matrix and proper waste form characteristics and/or complete dewatering.
 - < The description of the type and size of solid waste containers; the method of filling, handling and monitoring for removable radioactive contamination; and provisions for decontamination, packaging and storage.
 - < The provisions for on-site storage of solid wastes, the expected and design volumes, the expected radionuclide contents, and the design basis for these values.
 - < The quality group classifications of piping and equipment, and basis governing the classification chosen.
 - < Design provisions incorporated in the equipment and facility design to reduce leakage and facilitate operation and maintenance.
 - < Special design features, referenced topical reports, and previous experience with similar equipment and methods referenced in the SAR.
 - < The consequences of a liquid tank failure having the potential to release radioactive materials to a potable water supply as part of its review responsibility under SRP Section 15.7.3.
- C NRC is required to review the provisions to prevent, control, and collect releases of radioactive material in liquids due to tank overflows from all plant systems (outside reactor containment having the potential to incur such releases). NRC also is required to review design provisions incorporated in the equipment and facility design to reduce leakage and facilitate operation and maintenance and also review the consequences of a liquid tank failure having the potential to release radioactive materials to a potable water supply.
- C NRC inspectors are required to (1) determine whether the liquid waste systems incorporate provisions to prevent and collect leakage, overflows, and spillage in accordance with the licensee approved safety analysis report; and (2) establish whether procedures, instrumentation, and equipment to sample and handle radioactive liquids under accident conditions are adequate and operational.

A.19.4 Intent of NRC Requirements

The intent of NRC's program is twofold. First, to limit exposures to ALARA and minimize contamination of the facility and surrounding environment by ensuring that (1) containment buildings and tank systems incorporate engineering design features/controls and (2) licensees implement effective operating procedures to prevent liquid wastes (or mixtures of waste/precipitation) either under normal operations or postulated accidental events from either overflowing the tank and/or containment system, or remaining in direct contact

with waste containers. Second, to ensure that collected liquids (including wet wastes) are monitored, removed, and treated accordingly.

A.19.5 Comparison of Intents

The intents of the two programs are equivalent in that both RCRA and NRC's programs require containment buildings and tank systems to be well designed, constructed, operated, maintained, and inspected/repaired/tested. Although the RCRA program is more prescriptive in the design, construction, installation, and maintenance requirements of both the secondary containment system and tank system (including specific types of secondary containment systems and corrosion protection), the NRC system also requires that the components of the containment building and tanks systems be well designed so that they are physically and chemically resistant to the materials they are intended to handle under either normal or postulated accidental conditions. It should be noted that nuclear power plants are subjected to intense quality assurance and control procedures during both their construction and operation (e.g., they are required to provide the quality group classifications of piping and equipment, and basis governing the classification chosen), and are subjected to the full-time surveillance by resident NRC inspectors during the construction and operation of the facility. In addition, although RCRA prescribes the use of geotextiles and liner materials that meet minimum performance standards (e.g., hydraulic conductivity, thickness, and transmissivity) in construction of the secondary containment system (leak detection and containment components), NRC stipulates that facilities be constructed with the appropriate engineered features/controls. For example, foundations and walls are required to be designed and fabricated to contain the liquid inventory which might be released during a container/tank failure; materials should be compatible with the chemical, physical, and radioactive environment of specific applications during normal conditions and anticipated operational occurrences; and provisions to prevent leakage from entering unmonitored and nonradioactive systems and ductwork in the area must be incorporated into the design and operating procedures.

With respect to the RCRA requirements that both containment leak detection monitors/systems and tank systems need to be subjected to daily monitoring and inspections, the NRC's program differs only by allowing the licensee to determine the required frequency based on the rate of deterioration of the equipment and the probability of an incident; all tanks and containers are required to have provisions to monitor liquid levels and to alarm potential overflow conditions. NRC also requires that all radioactive waste management structures, systems, and components be designed to facilitate access, operation, inspection, testing, and maintenance in order to maintain radiation exposures to operating and maintenance personnel as low as is reasonably achievable and requires licensees to maintain standby equipment and alternative processing routes/interconnections so that failed equipment can be taken out of service at the earliest practicable time.

Lastly, the RCRA requirement that the collected liquid/wet waste be removed from the tank system and/or secondary containment system within 24 hours of detection (or the earliest practicable time) differs from that required by NRC in that (1) licensees are required to make provisions for sampling and treating all collected liquids, and (2) removal occurs as soon as it is safe for occupationally exposed individuals to enter an area. Although occupationally exposed individuals are generally able to handle LLW when the proper precautions and shielding are taken to reduce their exposures to ALARA, there may be circumstances or events that would prohibit occupationally exposed individuals from responding within 24 hours of detecting a release. However, this inability to respond within 24 hours in specific situations is consistent with the RCRA provisions for owner/operators to make demonstrations to the Regional Administrator that a removal cannot be carried out within 24 hours of detecting the release.

A.20 OPERATING STANDARDS

A.20.1 RCRA Requirements

40 CFR 264.1101(c)(1-4) requires that the owner/operator of a containment building undertake the following activities to ensure containment of the hazardous waste within the unit:

- C Maintain the primary barrier to be free of significant cracks, gaps, corrosion or other deterioration that could cause hazardous materials to be released from the primary barrier.
- C Maintain the level of the stored/treated hazardous waste within the containment walls of the unit so that the height of any containment wall is not exceeded.
- C Take measures to prevent the tracking of hazardous waste out of the unit by personnel or by equipment used in handling the waste.
- C Take measures to control fugitive dust emissions. In addition, all associated particulate collection devices (e.g., fabric filter, electrostatic precipitator) must be operated and maintained with sound air pollution control practices.

In addition to the above requirements, the owner/operator of the containment unit has to also ensure that:

- C A qualified registered professional engineer certifies that the containment building design meets the requirements of (a)-(c) of this statute as outlined above.
- C Upon detection of a condition that has led to the release of a hazardous waste an entry is made in the facility operating record, the defective portion of the building and leakages from the secondary collection system are removed, and appropriate notice to the Regional Administrator is provided.
- C Data gathered from monitoring equipment and leak detection equipment as well from the containment building are recorded in the facility's operating record.

A.20.2 Intent of RCRA Requirements

The intent of the RCRA program is twofold. First, to ensure that the integrity of the containment building's primary barrier is maintained and that measures are taken to prevent either trackout or fugitive dust emissions from the containment building. Second, to ensure that the facility's operating record is updated with information concerning the release and any monitoring data collected so that the facility can mitigate and/or prevent future releases.

A.20.3 NRC Requirements

NRC regulations and requirements related to operating standards are contained in 10 CFR 20.1101, 10 CFR 20.1406, 10 CFR 50.36, 10 CFR 50 (Appendix A), IE Circular No. 80-18, HYPPOS-239, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), and Inspection Procedures 65051, 84101, 84522-4, 84722-4, 84750, 84850, 84900, and 86750, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to maintain containment.)
- C Applicants for licenses, other than renewals, after August 20,1997, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.
- C In order to keep releases of radioactive materials to unrestricted areas during normal conditions, including expected occurrences, as low as is reasonably achievable, each licensee of a nuclear power reactor will include technical specifications that comply with the applicable provisions of 20.1301.
- C Potential release pathways of all radionuclides present in the solidified waste form shall be monitored. Surveillance programs shall incorporate adequate methods for detecting failure of container integrity and measuring releases to the environment. Monitoring shall be conducted to insure that levels are below limits specified in 10 CFR Part 20. All containers should be decontaminated to these levels.
- C The holder of a license authorizing operation of a production or utilization facility must seek NRC approval for making changes in/to the facility, procedures, and tests or experiments that involves a change in the technical specifications incorporated in the license or an unreviewed safety question.

- C Storage of low-level radioactive wastes beyond the period allowed by the license (if specified) or referenced in the FSAR by the licensee, without amending the license or performing a 10 CFR 50.59 evaluation and submitting an updated FSAR in accordance with 10 CFR 50.71 (e) may be a basis for enforcement action.
- C For outside storage of low level dry waste and solidified waste, the licensee is required to conduct periodic direct radiation and surface contamination monitoring to insure that levels are below limits specified in 10 CFR 20.1301.
- C While structures are not required to meet seismic criteria, protection should be afforded by the licensee to insure the radioactivity is contained safely by use of good engineering judgment, such as the use of curbs and drains to contain spills of dewatered resins or sludges.
- C Provision should be made by the licensee for additional reprocessing or repackaging due to container failure and/or, as required for final transporting and burial as per DOT and burial site criteria. Contamination isolation and decontamination capabilities should also be developed. When significant handling and personnel exposure can be anticipated, ALARA methodology should be incorporated as per Regulatory Guides 8.8, 8.10 (Revision 1), 8.18 (Revision 1), and 8.37.
- C Licensees are required to implement controls to segregate and minimize the generation of low-level dry waste to lessen the impact on waste storage.
- C The quantity of radioactive material allowed and the shielding configurations will be dictated by the dose rate criteria for both the site boundary and unrestricted areas onsite. The 40 CFR 190 limits will restrict the annual dose from direct radiation and effluent release to the Public (individual) to less than 25 mrem per year to the whole body from all sources of the Uranium fuel cycle; therefore, off-site doses from on-site storage must be sufficiently low to account for other sources. On-site dose limits associated with temporary storage will be controlled per 10 CFR Part 20 including the ALARA principle of 10 CFR 20.1003. The same standards apply for liquid radioactive waste storage, solidified radioactive waste storage, and for low level dry waste storage.
- C Licensees are required to make provisions to prevent, control, and collect releases of radioactive material in liquids due to tank overflows.
- C NRC reviews the adequacy of the facility's solid waste management systems by reviewing:
 - < The process flow diagrams showing the method of operation, the expected chemical content and radionuclide concentrations of liquid wastes to be processed and handled by the SWS, and the expected volumes to be returned to the liquid radwaste system for further treatment.
 - < The description of the methods for solidification (i.e., removal of free water), the description of methods for dewatering, the solidifying agent used, and the implementation of a process control program to ensure a solid matrix and proper waste form characteristics and/or complete dewatering.
 - < The description of the type and size of solid waste containers; the method of filling, handling and monitoring for removable radioactive contamination; and provisions for decontamination, packaging and storage.
 - < The provisions for on-site storage of solid wastes, the expected and design volumes, the expected radionuclide contents, and the design basis for these values.

- C NRC inspectors are required to: (1) determine whether the licensee has provided an adequate safety evaluation and developed quality assurance plans and procedures for the construction and operation of the facility; (2) determine whether adequate provisions have been established for the routine operation of the LLW storage facility; (3) establish whether there have been any changes to the facility and facility operations that could affect effluent monitoring requirements; (4) review changes in equipment, facility, procedures and operations for liquid, airborne and solid waste systems and determine whether these changes are in accordance with 10 CFR 50.59; (5) determine that the processing, control, and storage of solid wastes is in accordance with the license procedures, safety analysis TS, and applicable federal and state regulations; (6) determine whether preoperational, startup, and operational procedures have been written and approved; (7) determine whether procedures, instrumentation, and sampling and handling equipment are adequate and operational under accident conditions; (8) determine whether the licensee effectively controls and quantifies radioactive wastes during normal and emergency operations (by reviewing the adequacy of processing, control and storage systems); and (9) determine whether process and effluent monitors are maintained, calibrated, and operated as required.
- C NRC inspectors are also required to ensure that: (1) radioactive waste treatment systems are maintained and operated to keep offsite doses ALARA; (2) the licensee effectively controls, monitors and quantifies releases of radioactive materials in liquid, gaseous, and particulate forms to the environment; (3) radiological environmental monitoring programs are effectively implemented; (4) the licensee established and maintains adequate management-controlled procedures and quality assurance that reasonably ensure compliance with the requirements of 10 CFR Part 20 and 10 CFR Part 61 applicable to low-level radioactive waste (radwaste) form, classification, stabilization, and shipment manifests/tracking; (5) the LLW is being stored according to the licensee's accountability and security procedures for the waste; (6) the licensee is in compliance with possession limits; (7) the licensee's procedures for safe placement, inspection, and repackaging of LLW are adequate; (8) the licensee has conducted and properly documented inspections of LLW packages for integrity, radiation levels, and any required effluent sampling; (9) the licensee's records for waste placed in storage are adequate and that all LLW is accounted for.
- C Lastly, NRC inspectors are required to determine if the licensee has (1) incorporated the results of "lessons learned." as a result of any violations and corresponding corrective action which may have occurred since the last inspection, into lesson plans for employees who operate low-level waste processing equipment or for personnel involved in the transfer and packaging of radioactive material; and (2) provided management approved, detailed instructions and operating procedures for all personnel involved in the transfer, packaging, and transport of low-level radioactive waste with special attention given to controls on the chemical and physical form of the radioactive material and on the containment integrity of the packaging.

A.20.4 Intent of NRC Requirements

The intent of NRC's program is twofold. First, to ensure that the containment building is well designed, maintained, and operated to prevent the release of LLW (either as a solid, liquid, gaseous, or particulate) outside the containment building, including the plant environs and unrestricted areas, as verified through monitoring. Second, to ensure that the facility's lesson plans and operating procedures for employees who operate low-level waste processing equipment or for personnel involved in the transfer and packaging of radioactive material are updated with information concerning the release and any monitoring data collected so that the facility can mitigate and/or prevent future releases.

A.20.5 Comparison of Intents

The intents of the two programs are equivalent in that facilities under either program are required: (1) to maintain the integrity of the containment building's primary barrier; (2) to prevent either trackout or fugitive dust emissions from the containment building; and (3) to record information concerning the release and any monitoring data collected so that the facility can mitigate and/or prevent future releases.

A.21 SPECIAL REQUIREMENTS FOR CONTAINMENT BUILDINGS

A.21.1 RCRA Requirements

40 CFR 264.1101(d)(1-3) requires the owner/operator of the containment building to take measures to prevent the release of liquids or wet materials into areas without secondary containment and also maintain in the facility's operating log a written description of the operating procedures used to maintain the integrity of areas without secondary containment.

A.21.2 Intent of RCRA Requirements

To prevent the accidental release of wastes from containment buildings/areas by ensuring (1) that neither liquids nor wet wastes are managed in areas without secondary containment, and (2) the integrity of primary containment areas (without secondary containment systems) is maintained.

A.21.3 NRC Requirements

The NRC does not have any special requirements for containment buildings beyond those previously discussed above.

A.21.4 Intent of NRC Requirements

See Section A.20.

A.21.5 Comparison of Intents

Although NRC does not have any special requirements for containment buildings beyond those already discussed, the intents of the two systems are equivalent, in that facilities under either program are required to: (1) maintain the integrity of the containment building's primary barrier, and (2) prevent releases of any LLW from the containment building/area.

A.22 CLOSURE AND POST-CLOSURE CARE (Containment Buildings)

A.22.1 RCRA Requirements

40 CFR 264.1102 establishes the following standards:

- C At closure of the containment building, all waste residues, contaminated system components and contaminated subsoils must be removed or decontaminated and managed as hazardous waste, unless otherwise specified by EPA.
- C If, after removing or decontaminating all residues and making all reasonable efforts to affect removal or decontamination of contaminated components, subsoils, and equipment, it is found that not all contaminated subsoils can be practicably removed or decontaminated, the facility must be closed and post-closure care performed in accordance with post-closure requirements that apply to landfills (40 CFR 264.310).

A.22.2 Intent of RCRA Requirements

To ensure that facilities do not pose a threat to human health or the environment after operations at the facility have ceased by either requiring the removal of all hazardous wastes, residues, and contaminated materials (including liners, soils, etc.) from the non-disposal portions of the site, or the closure of the facility as a land disposal unit.

A.22.3 NRC Requirements

See Section A.17.

A.22.4 Intent of NRC Requirements

See Section A.17.

A.22.5 Comparison of Intents

See Section A.17.

A.23 CONTINGENCY PLANNING

A.23.1 RCRA Requirements

40 CFR 264.51 through 40 CFR 264.56 require that hazardous waste facilities have up-to-date contingency plans that are designed and implemented to minimize hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste

or hazardous waste constituents to air, soil, or surface water. The facility's contingency plan and emergency procedures should include/implement the following:

- C The plan must describe the actions facility personnel must take to comply with 40 CFR 264.51 and 264.56 in response to fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water at the facility.
- C The plan must describe arrangements agreed to by local police departments, fire departments, hospitals, contractors, and state and local emergency response teams to coordinate emergency services, pursuant to 40 CFR 264.37.
- C The plan must list names, addresses, and phone numbers (office and home) of all persons qualified to act as emergency coordinator (see 40 CFR 264.55), and this list must be kept up to date. Where more than one person is listed, one must be named as primary emergency coordinator and others must be listed in the order in which they will assume responsibility as alternates.
- C The plan must include a list of all emergency equipment at the facility (such as fire extinguishing systems, spill control equipment, communications and alarm systems (internal and external), and decontamination equipment), where this equipment is required. This list must be kept up to date. In addition, the plan must include the location and a physical description of each item on the list, and a brief outline of its capabilities.
- C The plan must include an evacuation plan for facility personnel where there is a possibility that evacuation could be necessary. This plan must describe signal(s) to be used to begin evacuation, evacuation routes, and alternate evacuation routes (in cases where the primary routes could be blocked by releases of hazardous waste or fires).
- C A copy of the contingency plan and all revisions to the plan must be maintained at the facility, and submitted to all local police departments, fire departments, hospitals, and state and local emergency response teams that may be called upon to provide emergency services.
- C The contingency plan must be reviewed, and immediately amended, if necessary, whenever the facility permit is revised; the plan fails in an emergency; the facility changes--in its design, construction, operation, maintenance, or other circumstances--in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency; the list of emergency coordinators changes; or the list of emergency equipment changes.
- C At all times, there must be at least one employee either on the facility premises or on call (i.e., available to respond to an emergency by reaching the facility within a short period of time) with the responsibility for coordinating all emergency response measures. This emergency coordinator must be thoroughly familiar with all aspects of the facility's contingency plan, all operations and activities at the facility, the location and characteristics of waste handled, the location of all records within the facility, and the facility layout. In addition, this person must have the authority to commit the resources needed to carry out the contingency plan.
- C Whenever there is an imminent or actual emergency situation, the emergency coordinator (or his designee when the emergency coordinator is on call) must immediately: (1) activate internal facility alarms or communication systems, where applicable, to notify all facility personnel; and (2) notify appropriate state or local agencies with designated response roles if their help is needed.

- C Whenever there is a release, fire, or explosion, the emergency coordinator must immediately identify the character, exact source, amount, and areal extent of any released materials. He may do this by observation or review of facility records or manifests, and, if necessary, by chemical analysis.
- C Concurrently, the emergency coordinator must assess possible hazards to human health or the environment that may result from the release, fire, or explosion. This assessment must consider both direct and indirect effects of the release, fire, or explosion (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated, or the effects of any hazardous surface water run-off from water or chemical agents used to control fire and heat-induced explosions).
- C If the emergency coordinator determines that the facility has had a release, fire, or explosion which could threaten human health, or the environment, outside the facility, he must immediately notify either the appropriate local authorities or the government official designated as the on-scene coordinator for that geographical area, (in the applicable regional contingency plan under part 1510 of this title) or the National Response Center (using their 24-hour toll-free number 800/424-8802).
- C During an emergency, the emergency coordinator must take all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur, or spread to other hazardous waste at the facility. These measures must include, where applicable, stopping processes and operations, collecting and containing release waste, and removing or isolating containers.
- C If the facility stops operations in response to a fire, explosion, or release, the emergency coordinator must monitor for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever this is appropriate.
- C Immediately after an emergency, the emergency coordinator must provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the facility.
- C The emergency coordinator must ensure that, in the affected area(s) of the facility that (1) no waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed; and (2) all emergency equipment listed in the contingency plan is cleaned and fit for its intended use before operations are resumed.
- C The owner or operator must notify the Regional Administrator, and appropriate state and local authorities, that the facility is in compliance with paragraph (h) of this section before operations are resumed in the affected area(s) of the facility.
- C The owner or operator must note in the operating record the time, date, and details of any incident that requires implementing the contingency plan. Within 15 days after the incident, he must submit a written report on the incident to the Regional Administrator.

A.23.2 Intent of RCRA Requirements

To minimize hazards to human health and the environment resulting from fires, explosions, or any unplanned sudden, or non-sudden release of hazardous waste or hazardous waste constituents to the air, soil, or surface water by requiring the facility to maintain an up-to-date contingency plan (with detailed emergency procedures) that clearly designates the emergency coordinator who is responsible for ensuring that the contingency plan and emergency procedures are followed.

A.23.3 NRC Requirements

NRC regulations and requirements related to contingency planning are contained in 10 CFR 50.47, Generic Letter #80-051 (Enclosure), Generic Letter #81-38 (Enclosure), Standard Review Plan, and Inspection Procedures 84523 and 86750, and include the following:

- C Licensees must prepare onsite and offsite emergency response plans that clearly identify:
- < Primary responsibilities for emergency response by the nuclear facility licensee and by state and local organizations within the Emergency Planning Zones have been assigned, the emergency responsibilities of the various supporting organizations have been specifically established, and each principal response organization has staff to respond and to augment its initial response on a continuous basis.
 - < On-shift facility licensee responsibilities for emergency response are unambiguously defined, adequate staffing to provide initial facility accident response in key functional areas is maintained at all times, timely augmentation of response capabilities is available and the interfaces between various onsite response activities and offsite support and response activities are specified.
 - < Arrangements for requesting and effectively using assistance resources have been made, arrangements to accommodate state and local staff at the licensee's near-site Emergency Operations Facility have been made, and other organizations capable of augmenting the planned response have been identified.
 - < A standard emergency classification and action level scheme, the basis of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and state and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures.
 - < Procedures have been established for notification, by the licensee, of state and local response organizations and for notification of emergency personnel by all organizations; the content of initial and followup messages to response organizations and the public has been established; and means to provide early notification and clear instruction to the populace within the plume exposure pathway Emergency Planning Zone have been established.
 - < Provisions exist for prompt communications among principal response organizations to emergency personnel and to the public.
 - < Information is made available to the public on a periodic basis on how they will be notified and what their initial actions should be in an emergency (e.g., listening to a local broadcast station and remaining indoors), the principal points of contact with the news media for dissemination of information during an emergency (including the physical location or

locations) are established in advance, and procedures for coordinated dissemination of information to the public are established.

- < Adequate emergency facilities and equipment to support the emergency response are provided and maintained.
 - < Adequate methods, systems, and equipment for assessing and monitoring actual or potential offsite consequences of a radiological emergency condition are in use.
 - < A range of protective actions has been developed for the plume exposure pathway for emergency occupationally exposed individuals and the public. Guidelines for the choice of protective actions during an emergency, consistent with federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway appropriate to the locale have been developed.
 - < Means for controlling radiological exposures, in an emergency, are established for emergency occupationally exposed individuals. The means for controlling radiological exposures shall include exposure guidelines consistent with EPA Emergency Worker and Lifesaving Activity Protective Action Guides.
 - < Arrangements are made for medical services for contaminated injured individuals.
 - < General plans for recovery and reentry are developed.
 - < Periodic exercises are (will be) conducted to evaluate major portions of emergency response capabilities, periodic drills are (will be) conducted to develop and maintain key skills, and deficiencies identified as a result of exercises or drills are (will be) corrected.
 - < Radiological emergency response training is provided to those who may be called on to assist in an emergency.
 - < Responsibilities for plan development and review and for distribution of emergency plans are established, and planners are properly trained.
- C Surveillance programs are required to incorporate adequate methods for detecting failure of container integrity and measuring releases to the environment.
- C Licensees are required to evaluate accident mitigation and control for design-based events (e.g., fire, flooding, tornadoes, etc.) and protect against them.
- C Provision should be made by the licensee for additional reprocessing or repackaging due to container failure and/or, as required for final transporting and burial as per DOT and burial site criteria. Contamination isolation and decontamination capabilities should also be developed. When significant handling and personnel exposure can be anticipated, ALARA methodology should be incorporated as per Regulatory Guides 8.8, 8.10 (Revision 1), 8.18 (Revision 1), and 8.37.
- C Licensees are required to prevent, control, and collect releases of radioactive material in liquids due to tank overflows. Licensees also are required to consider and incorporate in plant design the consequences of a liquid tank failure having the potential to release radioactive materials to a potable water supply.

- C NRC inspectors are required to (1) establish whether procedures, instrumentation, and equipment to sample and handle radioactive liquids under accident conditions are adequate and operational; (2) assess whether the licensee has provided for the identification of potential public health and safety problems resulting from the processing, packaging, and shipment, of low-level radioactive waste; and (3) determine if the licensee has incorporated the results of “lessons learned,” as a result of any violations and corresponding corrective action which may have occurred since the last inspection, into lesson plans for employees who operate low-level waste processing equipment or for personnel involved in the transfer and packaging of radioactive material.

A.23.4 Intent of NRC Requirements

To minimize hazards to human health and the environment resulting from fires, explosions, or any unplanned sudden, or non-sudden release of radiation to the air, soil, or surface water by requiring the facility to maintain an up-to-date contingency plan (with detailed emergency procedures) that clearly designates the emergency coordinator who is responsible for ensuring that the contingency plan and emergency procedures are followed.

A.23.5 Comparison of Intents

The intents of the two programs are equivalent in that facilities under either program are required to both prepare a detailed contingency plan with emergency procedures for dealing with releases resulting from fires, explosions, or any unplanned sudden, or not sudden event, and clearly identify the emergency coordinator. It should be noted that: (1) NRC requires that the means for controlling radiological exposures shall include exposure guidelines consistent with EPA Emergency Worker and Lifesaving Activity Protective Action Guides, which cover RCRA hazardous waste; and (2) unlike the RCRA program where the emergency coordinator must be located near by (e.g., living near the facility), NRC requires that an emergency coordinator be present at the site at all times.

B. COMPARISON OF THE EPA'S RCRA REQUIREMENTS AND THE NRC'S LICENSING REQUIREMENTS FOR THE ON-SITE TREATMENT (IN TANKS & CONTAINERS) AND STORAGE OF LOW-LEVEL MIXED WASTES AT NON-POWER NUCLEAR FACILITIES

Introduction

NRC also ensures that civilian uses of nuclear materials are carried out with adequate protection of the public health and safety, of the environment, and of national security at industrial facilities, medical/academic institutions, and government facilities. As of 1998, a total of approximately 23,000 licenses have been issued for medical, academic, and industrial uses of nuclear material; approximately one-third of these licenses are administered by the NRC and the remaining two-thirds are administered by 30 NRC Agreement States. Agreement States are states that have signed agreements with the NRC allowing them to regulate the use of radioactive material within their state. Three other states have applied for the Agreement States Program and include Ohio, Pennsylvania and Oklahoma.

Most facilities located in Agreement States are subject to regulatory requirements for radioactive material under state law. This applies to all source, special nuclear, and byproduct material except that from nuclear utilities and fuel cycle facilities, which are subject to NRC's requirements and DOE facilities, which are subject to DOE Orders.⁴ While states are required to adopt programs that are comparable with the NRC program, states may also adapt more stringent requirements.

As was described for nuclear power plants, NRC also has issued numerous performance-based regulations, regulatory guides, generic communications, NUREGs, and other documents that apply to material licenses. NRC and Agreement States use the various regulatory guides, generic communications, and NUREGs to guide licensees on how to meet the intent of the regulations. These documents work together to enable the NRC (and Agreement States) to ensure that material licensees are managing LLW in a manner that is safe to both human health and the environment.

NRC Regulations

NRC regulations of interest for material licensees are found at 10 CFR Chapter I -- Nuclear Regulatory Commission. A partial listing of the parts most relevant to the management of radioactive waste by material licensees includes:

- 10 CFR 20 - Standards for Protection Against Radiation
- 10 CFR 30 - Rules of General Applicability to Domestic Licensing of By-product Material
- 10 CFR 31 - General Domestic Licenses for By-product Material
- 10 CFR 32 - Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing By-product material
- 10 CFR 33 - Specific Domestic Licenses of Broad Scope for By-product Material
- 10 CFR 34 - Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations
- 10 CFR 35 - Medical Use of By-product Material
- 10 CFR 36 - Licenses and Radiation Safety Requirements for Irradiators
- 10 CFR 39 - Licenses and Radiation Safety Requirements for Well Logging

⁴ Fuel cycle facilities with greater than 350 grams of spent nuclear material are still subject to regulatory requirements for radioactive material under state law.

- 10 CFR 40 - Domestic Licensing of Source Material
- 10 CFR 71 - Licensing of the Packaging and Transportation of Radioactive Material

As stated earlier, the management of low-level radioactive waste is subject to a broad range of regulatory provisions. Licensees are required by NRC's general radiation protection standards (10 CFR Part 20) to ensure that radioactivity levels released to the environment are ALARA.⁵ Portions of 10 CFR Part 20 (Subpart K) also pertain to waste disposal, which is allowed by the NRC only by (1) transfer to an authorized recipient; (2) decay-in-storage; or (3) release in effluents, but only if within specified dose limits. The disposal and transportation of radioactive wastes are covered in 10 CFR 61 and 71, respectively.

Generic Communications

Generic communications of interest include:

- C **Information Notice No. 89-13**, "*Alternative Waste Management Procedures in Case of Denial of Access to Low-Level Waste Disposal Sites.*"
- C **Information Notice No. 90-09**, "*Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Material Licensees,*" and Attachment, "*Information Needed in an Amendment Request to Authorize Extended Interim Storage of Low-Level Radioactive Waste,*" February 5, 1990.
- C **Policy and Guidance Directive 94-05**, "*Updated Guidance on Decay-In-Storage,*" October 19, 1994.

NRC Reports

Specific NUREG documents of interest include **NUREG -SR1556**, "*Consolidated Guidance About Material Licenses*":

- C **NUREG-SR1556, V1**, "*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Portable Gauge Licenses.*"
- C **NUREG-SR1556, V2**, "*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Industrial Radiography Licenses.*"
- C **NUREG-SR1556, V6**, "*Consolidated Guidance About Material Licenses: Program-Specific Guidance about 10 CFR Part 36 Irradiator Licenses.*"
- C **NUREG-SR1556, V7**, "*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Academic, Research and Development, and other Licenses of Limited Scope.*"
- C **NUREG-SR1556, V8**, "*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Licenses for Exempt Distribution.*"
- C **NUREG-SR1556, V9**, "*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Medical Use Licenses.*"

⁵Waste management is also subject to standards set by EPA under 40 CFR Part 190.

- C **NUREG-SR1556, V10**, “*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Master Materials Licenses.*”
- C **NUREG-SR1556, V11**, “*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Licenses of Broad Scope.*”
- C **NUREG-SR1556, V13**, “*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Commercial Radiopharmacy Licenses.*”
- C **NUREG-SR1556, V14**, “*Consolidated Guidance About Material Licenses: Program-Specific Guidance about Well Logging, Tracer, and Field Flood Study Licenses.*”
- C **Various Inspection Procedures Utilized by NRC.**

In the remainder of this section, we present brief summaries of the relevant RCRA regulations, the intent of the relevant RCRA regulations, the corresponding NRC requirements, the intent of the corresponding NRC requirements, and a comparison of the intent of the two programs. Analyses of the RCRA Subpart DD - Containment Building regulations were not performed because: (1) these requirements are not relevant to the storage of LLMW by material licensees (i.e., we do not expect material licensees to be storing or treating wastes in containment buildings) and (2) the analyses (if performed) would have duplicated the analyses presented under Subpart I - Use and Management of Containers.

B.1 SECURITY

B.1.1 RCRA Requirements

40 CFR 264.14(a) requires that the owner/operator demonstrate to the regional administrator that physical contact with the waste or equipment within the facility will not cause injury to unknowing or unauthorized individuals and disturbance of the waste or equipment by unauthorized individuals will not violate security requirements. If the owner/operator is unable to successfully demonstrate these requirements, he/she must undertake the following activities:

- C Maintain a 24-hour surveillance system or build an artificial or natural barrier which completely surrounds the active portion of the facility.
- C Post a sign with the legend, “Danger - Unauthorized Personnel Keep Out,” at each entrance to the active portion of the facility, and at other locations, in sufficient numbers to be seen from any approach to the active section.

B.1.2 Intent of RCRA Requirements

To prevent the unauthorized handling of waste and unauthorized entry into waste storage areas, thereby protecting the health of both untrained individuals working around the storage area and members of the general public.

B.1.3 NRC Requirements

Security-specific regulations and requirements for licensed materials and waste are contained in 10 CFR 20, 10 CFR 34, 10 CFR 71, Information Notice 90-09, and Inspection Procedures 87100 through 87120 and 84900, and include the following:

- C Securing from unauthorized removal or access licensed material that are stored in controlled, secured (e.g., locked room) or unrestricted areas.
- C Controlling and maintaining constant surveillance of licensed material that is in controlled or unrestricted areas.
- C Attaching a clearly visible, durable, legible radiation control symbol label to the storage container.
- C Incorporating a feature, such as a seal, that is not readily breakable and that, while intact, would be evidence that a package has not been opened by unauthorized persons.
- C Protecting unauthorized operation of a package valve or other device.
- C It is expected that measures will be implemented to control access to storage areas.
- C Instituting, if applicable, controls, such as logging in and out, with the goal of recording entry into storage areas and use of licensed materials.
- C It is expected that visible signs will be posted on waste storage areas.
- C Using storage procedures, plans and engineering controls to achieve an occupational doses and doses to the public that are as low as reasonably achievable (ALARA).
- C Developing written procedures that work to implement a radiation protection program that includes periodic radiation and contamination surveys of packages and inspections of the storage area.
- C Limiting exposure rates to 0.1 mSv per hour at 1 meter from any exterior surface with sealed source in shielded position.
- C Supplying and requiring the use of individual radiation exposure monitoring devices.
- C It is expected that a Radiation Safety Officer will be designated who is responsible for implementing a radiation safety program and ensuring that radiation safety activities are being performed in accordance with approved procedures and license requirements.
- C It is expected that exposure rates will be monitored and that shielding will be provided (if necessary) to limit exposures per the requirements of 10 CFR 20.

B.1.4 Intent of NRC Requirements

The intent of the NRC requirements is twofold. First, to prevent the unauthorized handling or removal of waste/materials in order to limit radiation exposures to occupationally exposed individuals and members of the general public to ALARA through design considerations and controlling access to waste storage areas. Second, to ensure that an accounting of the waste/materials being handled and radiation exposures (if any) is maintained.

B.1.5 Comparison of Intents

The intents of the two programs are equivalent, in that both programs seek to prevent the unauthorized handling of waste products and entry into controlled areas that pose risks to either workers or members of the general public.

B.2 GENERAL FACILITY/CONTAINER INSPECTION REQUIREMENTS

B.2.1 RCRA Requirements

40 CFR 264.15(a)-(d) requires the owner/operator to undertake the following activities:

- C Inspect the facility for malfunctions, deterioration, operator errors, and discharges which may be causing--or lead to--hazardous waste release or a threat to human health.
- C Develop and follow a written schedule for inspecting monitoring, safety and emergency equipment. This schedule must be kept at the facility and identify the type of problems which are to be examined during inspection. The frequency of inspection may vary according to the items on the schedule.
- C Remedy any deterioration or malfunction of equipment and structures.
- C Maintain and record inspections in an inspection log for a period of three years from the date of inspection.

40 CFR 264.174 and 264.1101(c)(4) also require the owner/operator to inspect the container storage area or containment building, respectively, at least weekly, looking for leaking containers and for deterioration of containers and the containment system caused by corrosion or other factors.⁶

B.2.2 Intent of RCRA Requirements

The intent of the RCRA requirements is twofold. First, to develop and implement comprehensive waste storage/container area inspection, repair, and record keeping procedures so as to minimize/prevent exposure to employees and the general public resulting through release-related accidents. Second, to require facilities to maintain inspection logs for a predetermined period of time, so that regulatory compliance can be verified and to allow for the identification and correction of recurring incidents.

⁶40 CFR 264.15(c) and 264.171 require remedial action for deterioration or leaks detected.

B.2.3 NRC Requirements

Inspection-related regulations and requirements are contained in 10 CFR 20, 10 CFR 34, 10 CFR 35, 10 CFR 40, 10 CFR 71, Information Notice 90-09, and Inspection Procedures 87100 through 87120, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures as inspecting containers as often as necessary.)
- C Surveying radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with dose limits for individual members of the public.
- C Inspecting equipment daily and inspecting transport and storage containers, associated equipment, survey instruments, and source changers quarterly.
- C If employing decay-in-storage procedures for materials with a half-life of less than 120 days and planning on disposing of the material in ordinary trash, it is expected that container surfaces are monitored before disposal and that it be determined and that the container's radioactivity not be distinguishable from background radiation.
- C Establishing measures to indicate, by use of markings (e.g., stamps, labels, etc.) the status of inspections and tests performed upon individual items of the packaging.
- C It is expected that effluent monitoring systems and associated analytical equipment are adequate to detect and quantify effluents with sufficient sensitivity, and it is expected that equipment be maintained, calibrated, and operated in accordance with manufactures' recommendations and good health physics practices.
- Developing a schedule to achieve compliance with environmental requirements, ALARA limitations, and associated license conditions regarding inspections.
- It is expected that a diagram of the storage area, demonstrating waste storage locations and inspection access routes, will be provided.
- It is expected that a program will be developed for periodic inspections of packages to ensure waste/package stability.
- C Taking corrective actions or planning corrective actions to prevent the recurrence of a release or malfunction, including inspections.
- C Establishing measures to assure that conditions adverse to quality, such as deficiencies, deviations, defective material, and nonconformance, are promptly identified and corrected.
- C Keeping records of spills or other unusual occurrences involving the spread of contamination, limiting record keeping to instances where contamination remains after cleanup or when there is the possibility that contaminants may have spread to inaccessible areas.
- C Recording problems found with any equipment associated with management of waste, transport and storage containers, survey instruments, and source changers and keeping these records for three years.

- C Documenting the quarterly inspections of transport and storage containers, associated equipment, survey instruments, and source changers.

B.2.4 Intent of NRC Requirements

The intent of the NRC requirements is twofold. First, to prevent the uncontrolled release of waste products by performing a comprehensive visual/physical inspection of container/package integrity. Second, to ensure that corrective action plans are inspections plans/schedules are updated, and to verify regulatory compliance through review of inspection-related documentation.

B.2.5 Comparison of Intents

The intents of both programs are equivalent in that facilities under both programs required to implement inspection programs that serve to maintain container/package integrity and facilitate the identification of releases that if not stopped, could pose significant risk to public health and the environment. In addition, both programs require that records of corrective actions, inspection and scheduling plans, and inspection results be maintained for three years. Although both programs allow facilities to base the frequency of inspection on the rate of deterioration of the equipment and the probability of an incident, the RCRA program requires an inspection frequency of at least weekly. NRC requires licensees to conduct at least quarterly inspections (daily, if waste retention systems are in place); however, if based upon the rate of deterioration of the equipment, containers, or the probability of an incident, the licensee would be required to either redesign the equipment or container and/or increase the frequency of inspection to account for the rate of corrosion or probability of an incident.

B.3 PERSONNEL TRAINING

B.3.1 RCRA Requirements

Under 40 CFR 264.16(a)-(e) all facility personnel are required to undertake the following activities:

- Complete a program of classroom instruction or on-the-job training that is directed by a person trained in hazardous waste management procedures, and which teaches procedures (including contingency plan implementation) relevant to the positions occupied by the facility personnel. The program must familiarize facility personnel with emergency procedures and systems.
- Successfully complete the program within six months of the date of their employment or assignment to the facility, or to a new position at a facility, whichever is later.
- Take part in an annual review of the initial training.

In addition, the owner/operator must maintain the job description and training records of all personnel until closure of the facility.

B.3.2 Intent of RCRA Requirements

The intent of the RCRA program is twofold. First, to institute mandatory, annual training requirements for individuals working/handling hazardous waste so that they will have the knowledge to properly manage waste, prevent spills, and implement emergency response actions. Second, to document that workers receive initial training and to ensure that workers receive annual refresher training.

B.3.3 NRC Requirements

Personnel training-related regulations and requirements are contained in 10 CFR 19, 10 CFR 20, NUREG SR1556 (V7 - V13), and Inspection Procedures 87100 through 87120, and include the following:

- Informing occupationally exposed individuals of the storage, transfer, or use of radiation and/or radioactive material.
 - Instructing occupationally exposed individuals in health protection problems associated with exposure to radiation, in precautions or procedures to minimize exposure, and in the purposes and functions or protective devices employed.
- C A certification that the applicant has met its responsibilities under EPCRA Title III, if applicable to the applicant's activities at the proposed place of use of the byproduct material.
- Briefing employees on the frequency, performance objective and plans for the training that occupationally exposed individuals will receive on how to respond to an emergency.
 - Appointing a Radiation Safety Officer responsible for implementing a radiation safety protection program.
 - Providing appropriate training to waste handlers.

B.3.4 Intent of NRC Requirements

The intent of the NRC program also is twofold. First, to institute mandatory, training requirements for occupationally exposed individuals working/handling LLW so that they will have the knowledge to properly manage waste, prevent spills, and implement emergency response actions. Second, to document that occupationally exposed individuals receive initial training and to ensure that occupationally exposed individuals receive periodic refresher training.

B.3.5 Comparison of Intent

The intents of the two programs are equivalent, as both programs require facilities to develop and implement employee training programs to ensure that workers are instructed on how to properly manage waste, prevent spills, and implement emergency response actions. Although EPA's program is focused on the non-radiological hazards (toxicity, reactivity, ignitability, explosivity, etc.) and NRC's program is focused on the radiological hazards of the waste, all U.S. facilities are subject to the training requirements established by both the Occupational, Safety, and Health Agency (OSHA) for protecting worker safety from hazardous chemicals and situations (including EPCRA Title III's hazard communication requirements - posting of Material Safety Data Sheets for hazardous products used, etc.) and the Department of Transportation (DOT) requirements for the safe transport of hazardous materials. Furthermore, in accordance with NRC requirements to both safely manage LLW and prevent releases of LLW, any hazard (chemical or other) that could affect the safe handling of LLW needs to be considered in the design of the storage area and accounted for in the site's operating procedures. Lastly, although the NRC does not establish a minimum

frequency for training or when training should be offered, NRC does stipulate that it is necessary to appoint a Radiation Safety Officer who is responsible for implementing the site's radiation safety protection program and ensuring that training is provided.

B.4 GENERAL REQUIREMENTS FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTES

B.4.1 RCRA Requirements

CFR 264.17(a)-(b) stipulates that the owner/operator must take precautions to prevent accidental ignition or reaction of ignitable or reactive waste, such as through waste segregation, warning signs, and use of appropriate protective measures (e.g., fume hoods and "No Smoking" signs). In mixing incompatible or incompatible wastes and other materials, the owner/operator must ensure against uncontrolled releases such as fire, explosion and fumes.

B.4.2 Intent of RCRA Requirements

To require the owner/operator to take the necessary precautionary measures to prevent accidental ignition, reaction of ignitable wastes, releases, explosions, and fume generation resulting from improper mixing procedures or from the inherent instability of some wastes.

B.4.3 NRC Requirements

NRC regulations and requirements related to ignitable, reactive, or incompatible wastes are contained in 10 CFR 20, 10 CFR 71, NUREG-SR1556 (V7 through V13), Inspection Procedures 87100 through 87120, and Information Notice 90-09, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to prevent mixing of incompatible materials.)
- C Packages must be made of materials and construction that assure that there will be no significant chemical, galvanic, or other reaction among the packaging components, among packaging contents, or between the packaging components and the package contents, including possible reactions resulting from leakage of water, to the maximum credible extent.
- C The decomposition and chemical reaction of incompatible waste materials over time can result in gas generation or other reaction products. Therefore, licensees should evaluate what they are planning to store and use measures to prevent these reactions. Further, licensees should determine if the need exists for additional ventilation or fire protection/suppression systems.
- C Licensees must ensure that their waste management program includes procedures for the handling of waste, safe and secure storage, characterization, minimization, and disposal of radioactive waste. Licensees also must describe how the adverse effects of extremes of temperature and humidity on waste and waste containers will be avoided.
- C Licensees should assure that adequate space and facilities are available for the storage of LLW. Licensees can minimize the need for storage space, if the waste is segregated according to physical half-life. Waste containing radioisotopes of physical half-lives within a certain range may be stored in one container and allowed to decay-in-storage for ten half-lives of the longest-lived radioisotopes in the container.

B.4.4 Intent of NRC Requirements

To require facilities to consider the chemical properties (including ignitability, reactivity, explosivity, etc.) of the LLW in both the design of, and the writing of standard operating procedures for the facility and associated waste handling systems, storage containers, and storage areas to prevent accidental ignition, reaction of ignitable wastes, releases, explosions, and fume generation resulting from either the improper or accidental mixing of LLW.

B.4.5 Comparison of Intents

The intents of the two programs are equivalent in that both require the anticipation, recognition, and prevention of accidental ignition, reaction of ignitable wastes, releases, explosions, and fume generation resulting from either the improper or accidental mixing of wastes. It should be noted that NRC expressly allows licensees to mix wastes containing radioisotopes of physical half-lives within a certain range so that they may be stored in one container and allowed to decay-in-storage for ten half-lives of the longest-lived radioisotopes in the container; however, licensees are still required to consider, prevent and/or mitigate possible chemical interactions.

B.5 LOCATION STANDARDS

B.5.1 RCRA Requirements

40 CFR 264.18(a)-(c) establishes the following location standards for the siting of treatment, storage and disposal facilities:

- C Prohibits the siting of portions of new facilities where treatment, storage or disposal occurs within 61 meters (200 feet) of a fault which has had displacement in Holocene time.
- C Stipulates that a facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless EPA provides otherwise.
- C Prohibits the placement of any noncontainerized or bulk liquid hazardous waste in any salt dome formation, salt bed formation, underground mine, or cave.

B.5.2 Intent of RCRA Requirements

To ensure that facilities are constructed in areas not subject to seismic activity and if sited in a 100-year floodplain, that sufficient design and operating controls be implemented to prevent the washout of waste from the facility.

B.5.3 NRC Requirements

NRC regulations and requirements related to facility location are contained in 10 CFR 20, Information Notice 90-09, Inspection Procedure 84900, and joint NRC/EPA guidance documents, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

- C Material licensees are required to: (1) describe the type of building/structure in which the waste will be stored and demonstrate that the waste will be protected from weather at all times; (2) describe the vulnerability of the storage location to hazards such as tornados, hurricanes, floods, and industrial accidents, etc.; and (3) mitigate through engineered features any event potentially posing a risk to the waste storage area.
- C NRC inspectors are required to observe the storage areas to determine adequacy with respect to: protection from environmental elements; fire and flooding; avoidance of temperature/humidity extremes; and, ventilation considerations.

B.5.4 Intent of NRC Requirements

To ensure that site characteristics are considered in the design, construction, and operation of storage facilities so as to limit occupational doses and doses to members of the public that are ALARA.

B.5.5 Comparison of Intents

The intents of both programs are equivalent in that facilities under both programs are required to prevent releases or spills caused by natural and man-influenced disasters or occurrences. Although RCRA provides specific guidelines for the siting of waste storage facilities, NRC only requires the license applicant to consider/mitigate the hazards to the storage area and describe them in their licensee application. However this difference is not significant because NRC will not grant a licensee to any applicant which proposes to site a facility that is subject to undue risks for which sufficient engineered design features were not included to mitigate such postulated occurrences.

B.6 REQUIRED AISLE SPACE

B.6.1 RCRA Requirements

40 CFR 264.35 requires the owner/operator to maintain aisle space to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of facility operation in an emergency, unless it can be demonstrated to the Regional Administrator that aisle space is not needed for any of these purposes.

B.6.2 Intent of RCRA Requirements

To ensure that personnel and emergency responders have sufficient aisle space to allow them to conduct their jobs unconstrained by physical space limitations anywhere in the facility.

B.6.3 NRC Requirements

NRC regulations and requirements related to aisle space are contained in 10 CFR 20, NUREG SR1556 (V7 through V13), and Inspection Procedure 87110 series, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures as providing for sufficient aisle space to allow occupationally exposed individuals sufficient work space to conduct their jobs safely.)
- Assuring that adequate space and facilities are available for the storage of waste (licensees can minimize the need for storage space, if the waste is segregated according to physical half-life).

- Allowing access to wastes.
- Allowing necessary housekeeping around waste packages.
- Allowing adequate visibility to permit identification of unsafe conditions.

B.6.4 Intent of NRC Requirements

To ensure that sufficient space exists for occupationally exposed individuals to be able to both observe waste containers (for integrity and accountability purposes) and to perform housekeeping.

B.6.5 Comparison of Intents

The intents of the two programs are equivalent in that containers must be stored in a manner which permits their inspection and access for maintenance (including repacking). Although the RCRA program specifies that there must be enough aisle space for workers and emergency responders, the NRC program accomplishes the same objective through requiring that the facility be designed and operated in a manner that controls radiation exposure to ALARA. Specifically, in order for emergency responders to control a fire or other event so that radiation exposures are kept to ALARA, they must be able to have sufficient space to conduct their work, which would include sufficient physical space for moving, using, and decontaminating emergency equipment.

B.7 ARRANGEMENTS WITH LOCAL AUTHORITIES

B.7.1 RCRA Requirements

40 CFR 264.37(a)-(b) requires the owner/operator to make the following arrangements:

- C Arrangements to familiarize police, fire departments, and emergency response teams with the facility, nature of wastes handled, and other safety considerations.
- C Arrangements designating primary emergency authority.
- C Arrangements with state emergency response teams, emergency response contractors, and equipment suppliers.
- C Arrangements to familiarize local hospitals with the wastes handled and the potential injuries.

In instances where the state or local authorities decline to enter into such arrangements, the owner/operator must document the refusal.

B.7.2 Intent of RCRA Requirements

The intent of the RCRA program is twofold. First, to ensure that emergency responders, who understand the nature of the wastes and hazards posed by the wastes at the site, are available and able to take the necessary precautions to quickly and safely respond to site emergencies. Second, to ensure that injured individuals have access to and receive proper medical attention in a life-saving (timely) manner.

B.7.3 NRC Requirements

NRC regulations and requirements related to arrangements with local authorities are contained in 10 CFR 20.2203, 10 CFR 30.32(g), and Information Notice 90-09, and include the following:

- C Corrective steps taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, ALARA constraints, generally applicable environmental standards, and associated license conditions.
- C Licensees must make provisions for conducting quarterly communication checks with the off-site response organizations to check and update all necessary telephone numbers and contacts. In addition, the licensees must make provisions for having biennial on-site exercises to test response to simulated emergencies.
- C Licensees must describe their procedures for responding to emergencies, including notification of and coordination with local fire, police, and medical departments.

B.7.4 Intent of NRC Requirements

To ensure that the licensee has procedures for notifying and coordinating emergency response actions with emergency responders from the local fire, police, and medical service providers.

B.7.5 Comparison of Intents

The intents of these two programs are equivalent in that facilities are required to identify and coordinate with emergency responders from the local fire, police, and medical service providers. In addition, as part of the Emergency Planning and Community Right-to-Know Act (EPCRA), OSHA requirements, and local fire ordinances and codes, the owner/operator is required to identify hazardous materials used at the facility so that employees, members of the response organizations (including the fire department), and general public can be prepared to take the appropriate actions.

B.8 RECORD KEEPING REQUIREMENTS

B.8.1 RCRA Requirements

40 CFR 264.73(a-b) requires that the owner/operator maintain a written operating record and that the operating record must document the description and quantity of wastes handled, the location of each waste within the facility, records of all incidents that require implementation of the contingency plan, and details of closure cost estimates and, post-closure cost estimates (for disposal facilities).

In addition, 40 CFR 264.74(a-b) requires that the owner/operator furnish all records upon request by the EPA, and also submit a copy of records of waste disposal locations under 40 CFR 264.73 (b)(2) to the Regional Administrator and local land authority upon closure of the facility.

B.8.2 Intent of RCRA Requirements

To ensure that facilities (1) maintain accurate records of how much and where wastes are managed onsite, and (2) can safely operate their facility by knowing about all incidents that required implementation of the site's contingency plan so that they can incorporate "lessons learned" into updated operating procedures and contingency plan.

B.8.3 NRC Requirements

Specific requirements related to record keeping are contained in 10 CFR 20 Subpart L, 10 CFR 30, 10 CFR 34, Information Notice 90-09, and Inspection Procedures 87110 series and 84900, and include the following:

- C Records of information important to the decommissioning of the facility must be kept in an identified location until the site is released for unrestricted use.
- C Identifying and providing a diagram of the storage area demonstrating storage procedures and inspection accessibility.
- C Tracking amounts of material in storage and verifying compliance with possession limits.
- C Maintaining records of doses received by all individuals for whom monitoring was required.
- C Maintaining records of doses received during planned special exposures, accidents, and emergency conditions.
- C Maintaining inspection reports as required under the license.
- C Maintaining records of spills or other unusual occurrences involving the spread of contamination in and around the facility (limiting record keeping to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas).
- C Maintaining records of equipment problems found in daily checks.
- C Maintaining records, for three years, of quarterly inspections of radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments.
- C It is expected that in smaller facilities, licensees will maintain an accounting system that tracks receipt records, disposal records, and records of any transfers of material.
- C It is expected that in larger facilities, licensees will maintain a sophisticated accounting system for all licensed material that provides accurate information on the receipt, location, the quantity used and disposed of, the amount transferred to other laboratories operating under the same license, the amount remaining after decay, the amount held for decay in storage, the amount held for near-term disposal, and the quantity transferred to other licensees.
- C It is expected that routine physical audits to ensure the accuracy of the accounting systems will be performed.

B.8.4 Intent of NRC Requirements

To ensure that licensees: (1) maintain accurate records of how much and where wastes are stored, (2) maintain records of the radiation exposures received by occupationally exposed individuals and visitors, and (3) can safely operate their facility by knowing about all incidents that required implementation of the site's contingency plan so that they can incorporate "lessons learned" into updated operating procedures, inspection plans, and contingency plans.

B.8.5 Comparison of Intents

The intents of the two programs are equivalent in that they both require (1) accurate record keeping of the types and volumes of wastes stored at the facility, and (2) that information gained by the facility in responding to previous events is incorporated into an updated contingency plan so that the facility can be in a better position to prevent/respond to future events. It should be noted that although RCRA stipulates that details of closure and post-closure cost estimates be kept in the site's operating record, the NRC requires

that information important to the decommissioning of the facility be kept in an identified location until the site has been released for unrestricted use. This difference, however, does not affect the site's ability to safely store LLW.

B.9 REPORTING REQUIREMENTS

B.9.1 RCRA Requirements

40 CFR 264.75(a-e) requires that the owner/operator submit a single copy of a biennial report to the Regional Administrator by March 1 of each even numbered year (submitted on EPA form 8700-13B). The report must include the name and address of the facility, type of waste handled by the facility, method of treatment, storage or disposal, closure cost and post-closure cost estimates (for disposal facilities) and, for off-site facilities, the EPA identification number of each hazardous waste generator from which the facility received a hazardous waste during the year.

B.9.2 Intent of RCRA Requirements

To enable EPA to both maintain a tracking/accounting system of hazardous waste activities taking place at facilities throughout the country and study waste generation rates, handling procedures, treatment practices, disposal trends, and other issues (such as measuring progress in pollution prevention).

B.9.3 NRC Requirements

NRC regulations and requirements related to reporting are contained in 10 CFR 20 Subpart M (Appendix F and Appendix G) and includes the following:

- C A waste generator, collector, or processor who transports, or offers for transportation, low-level radioactive waste intended for ultimate disposal at a licensed low-level radioactive waste land disposal facility must prepare a Manifest reflecting information requested on applicable NRC forms 540 and 541, and if necessary, on an applicable NRC form 542. NRC forms 540 and 540A must be completed and must physically accompany the pertinent low-level waste shipment.

B.9.4 Intent of NRC Requirements

To ensure that a paper trail documenting the ultimate disposition of LLW is created.

B.9.5 Comparison of Intents

With one exception, the intents of the two programs are equivalent in that both systems require facilities to create a paper trail to document the ultimate disposition of waste (from "cradle-to-grave") by using waste manifests that also provide the information required by the Department of Transportation (DOT). The one exception between the two programs is that the NRC does not require facilities to submit biennial reports. The lack of such "administrative" reporting, however, does not affect the storage of waste at the facility and NRC has other procedures for monitoring waste generation and management trends (including pollution prevention), such as having inspectors review operating records detailing types and volumes of waste stored onsite and processing manifests.

B.10 CONDITION OF CONTAINERS

B.10.1 RCRA Requirements

40 CFR 264.171 stipulates that if a container holding hazardous waste is not in good condition (e.g., severe rusting, apparent structural defects) or if it begins to leak, the owner/operator must transfer the hazardous waste from this container to a container that is in good condition or manage the waste in some other way that complies with the requirements of this part.

B.10.2 Intent of RCRA Requirements of RCRA Requirements

To ensure that container integrity is maintained and to minimize threat to either human health or the environment from releases of hazardous waste.

B.10.3 NRC Requirements

NRC regulations and requirements related to the conditions of containers are found in 10 CFR 20.1101, 10 CFR 71, Information Notice 90-09, NUREG-SR1556 (V7-V13), and Inspection Procedures 84900 and 87100 through 87120, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures as inspecting containers and determining that they do not pose a risk.)
- C Packages must be made of materials and construction that assure that there will be no significant chemical, galvanic, or other reaction among the packaging components, among packaging contents, or between the packaging components and the package contents, including possible reaction resulting from leakage of water, to the maximum credible extent.
- C It is expected that radioactive waste will be stored in appropriate containers until its disposal.
- C It is expected that the integrity of packaging (adequate for the expected term of storage) and waste form will be maintained.
- C It is expected that waste will be shielded from the elements and from extremes of temperature and humidity.
- C Depending on the type of waste involved, it is expected that procedures and equipment be in place to repack the waste, should the need arise (including equipment for remote handling of waste).
- C It is expected that the licensee will conduct and properly document inspections of LLW packages to assure they maintain integrity.
- C It is expected that waste or waste packages be stored/placed in a stable manner.

B.10.4 Intent of NRC Requirements

To ensure that container integrity is maintained and to minimize threat to either human health or the environment from releases of LLW.

B.10.5 Comparison of Intents

The intents of the two programs are equivalent in that both programs require facilities to maintain container integrity and to mitigate container failure through repackaging.

B.11 COMPATIBILITY OF WASTE WITH CONTAINERS

B.11.1 RCRA Requirements

40 CFR 264.172 requires that the owner/operator must use a container made of or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired.

B.11.2 Intent of RCRA Requirements

To ensure that container integrity is maintained by placing only wastes that are compatible with the container material in the waste container.

B.11.3 NRC Requirements

NRC regulations and requirements related to the compatibility of waste with containers are found in 10 CFR 20.1101, 10 CFR 71, and NUREG-SR1556 (V7-V13), and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable. (This requirement would include such operating procedures as ensuring that wastes are compatible with the container.)
- C Constructing waste package of materials that will have no significant chemical, galvanic, or other reactions (to the maximum credible extent) with the stored material, packaging components, other package contents, and water from leakage.
- C It is expected that the waste will not pose a hazard to the integrity of packages or containers used in storing that waste.
- C The decomposition and chemical reaction of incompatible waste materials over time can result in gas generation or other reaction products, which needs to be considered in selecting waste container types and identifying measures to prevent these reactions from occurring is necessary.
- C Licensees must ensure that their waste management program includes procedures for the handling of waste, safe and secure storage, characterization, minimization, and disposal of radioactive waste. Licensees also must describe how the adverse effects of extremes of temperature and humidity on waste and waste containers will be avoided.

B.11.4 Intent of NRC Requirements

To ensure that container integrity is maintained by placing only wastes that are compatible with the container material in the waste container.

B.11.5 Comparison of Intents

The intents of the two programs are equivalent in that both programs promote container integrity by requiring facilities to consider the characteristics of the wastes to be containerized when selecting appropriate containers.

B.12 MANAGEMENT OF CONTAINERS

B.12.1 RCRA Requirements

40 CFR 264.173(a) requires the owner/operator to ensure that a container holding hazardous waste must always be closed during storage, except when adding or removing waste. In addition, 40 CFR 264.173(b) requires that the owner/operator ensure that the container holding hazardous waste must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.

B.12.2 Intent of RCRA Requirements

To protect human health and the environment by ensuring that waste containers are managed in a manner that reduces the risk of air releases or spills.

B.12.3 NRC Requirements

NRC regulations and requirements related to the management of containers are found in 10 CFR 20.1101, 10 CFR 35, and 10 CFR 71, and Inspection Procedure 87110, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. The licensee also is required to provide a general description of the provisions for packaging, storage, and shipment offsite of solid waste containing radioactive materials resulting from treatment of gaseous and liquid effluents and from other sources in its license application. Licensees also are required to prepare management-approved, detailed operating procedures to all personnel involved in the transfer, packaging, and transport of LLW.
- C Storing volatile radio-pharmaceuticals and radioactive gases in the shipper's radiation shield and container or in glove boxes.
- C Protecting the package valve or other device, the failure of which would allow radioactive contents to escape, against unauthorized use and operation.
- C Providing, in the design of the package, an enclosure for the package valve or other device to retain any leakage (not applicable to pressure relief devices).
- C It is expected that the licensee will establish measures to control, in accordance with instructions, the handling, storage, shipping, cleaning, and preservation of materials and equipment to be used in packaging to prevent damage or deterioration.
- C To ensure integrity of packaging and maintenance of waste form, stored waste should be shielded from the elements and from extremes of temperature and humidity.
- C Waste is stored and controlled in a secure and safe manner.

B.12.4 Intent of NRC Requirements

To ensure that licensees both (1) incorporate engineered features into the design of their waste storage areas and waste containers, and (2) develop standard operating procedures for handling and managing waste containers to ensure that radiation exposures are kept to ALARA under normal and postulated accident conditions.

B.12.5 Comparison of Intent

The intents of the two programs are equivalent as both programs protect human health and the environment by ensuring that waste containers are managed in a manner that reduces the risk of air releases or spills. Although the RCRA program specifically states that containers must always be closed during storage, except when adding or removing waste, the NRC obtains the same result by requiring licensees to limit radiation releases to ALARA. Specifically, waste container lids are part of the engineering design of the waste containment system, and the waste container must be sealed if the licensee is to control radiation releases to ALARA.

B.13 CONTAINMENT (LIQUIDS)

B.13.1 RCRA Requirements

40 CFR 264.175 (a)-(b) stipulates specific containment provisions for container storage areas holding liquid hazardous waste, as follows:

- C A base must underlie the containers which is free of cracks or gaps and is sufficiently impervious to contain leaks, spills and accumulated precipitation until the collected material is detected and removed.
- C The base must be sloped or the containment system must be otherwise designed and operated to drain and remove liquids resulting from leaks, spills, or precipitation, unless the containers are elevated or are otherwise protected from contact with accumulated liquids.
- C The containment system must have sufficient capacity to contain 10% of the volume of containers or the volume of the largest container, whichever is greater.
- C Run-on into containment system must be prevented unless collection system has sufficient excess capacity to contain any run-on that might enter into the system.
- C Spilled or leaked waste and accumulated precipitation must be removed from the sump or collection area in as timely a manner as is necessary to prevent overflow of the collection system.

B.13.2 Intent of RCRA Requirements

To ensure that storage areas are designed to prevent liquid wastes (or mixtures of waste/precipitation) from either overflowing (or leaking from) the storage facility's containment system, or remaining in direct contact with the waste containers in the storage facility.

B.13.3 NRC Requirements

NRC regulations and requirements related to the containment of liquids are contained in 10 CFR 20, 10 CFR 71, Information Notice 90-09, and Regulatory Guide 10.5, and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such engineering controls necessary to contain a spill to reduce and/or prevent exposure of radioactive materials to occupationally exposed individuals.)
- C It is expected that the facility's design and operational procedures will work to minimize contamination of the facility and the environment, facilitate eventual decommissioning, and minimize the generation of radioactive waste.
- C Liquid wastes or wastes containing liquid must be converted into a form that contains as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5 percent of the volume of the waste for waste processed to a stable form.
- C Conforming with the following package requirements: (1) the smallest overall dimension of a package may not be <10 cm; (2) the outside of a package must incorporate a feature, such as a

seal, that is not readily breakable and that, while intact, would be evidence that the package has not been opened by unauthorized persons; and (3) package must include a containment system securely closed by a positive fastening device that cannot be opened unintentionally or by a pressure that may arise within the package.

- C Constructing waste package of materials that will have no significant chemical, galvanic, or other reactions (to the maximum credible extent) with the stored material, packaging components, other package contents, and water from leakage, to the maximum credible extent (licensees must consider the behavior of materials under irradiation).
- Providing, in the design of the package, an enclosure for the package valve or other device to retain any leakage (not applicable to pressure relief devices).
 - Depending on the type of waste involved, it is expected that licensees will have procedures and equipment in place or have access to equipment, necessary to repackage the waste, should the need arise.
 - Licensees are required to describe, for each category of use, the minimum physical plant requirements, such as fume hoods, glove boxes, waste receptacles, special sinks, ventilation and containment systems, effluent filter systems, and sketch each area where hazardous materials are used and stored or where hazardous operations are performed (e.g., centralized radioisotope laboratory used for iodinations or bulk waste storage).
 - Licensees are required to describe the packages or containers to be used for storage of LLW, and hazards the waste may pose to their integrity, and the projected storage life of the packages or containers.

B.13.4 Intent of NRC Requirements

To limit occupational doses and doses to members of the public to ALARA through procedures and engineering controls, which are based upon sound radiation protection principles and containment of the LLW (including liquids) within the waste container/package.

B.13.5 Comparison of Intent

The intents of the two programs are equivalent in that both programs seek to prevent the migration of liquids beyond the storage unit boundaries; however, the two programs obtain this goal through two different means. Specifically, RCRA has prescriptive requirements to ensure that storage areas are designed to prevent liquids (or mixtures of waste/precipitation) from either overflowing (or leaking from) the storage facility's containment system, while preventing the waste containers in the storage facility from being in direct contact with collected liquids. The NRC requirements, however, emphasize packaging design and require that the waste package include a containment system capable of containing releases for as long as the waste remains in storage. In addition, NRC expects that LLW will be shielded from the elements and from extremes of temperature and humidity; therefore, provisions for collecting, containing, and removing precipitation are not required. In any case, NRC expects that licensees will have procedures and equipment in place (or have access to equipment) necessary to both respond to spills or leakage of LLW from containers and repackage the waste, should the need arise.

B.14 CONTAINMENT (NON-LIQUIDS)

B.14.1 RCRA Requirements

40 CFR 264.175(c) stipulates that storage areas that store containers holding only wastes that do not contain free liquids need not have a containment system provided that:

- C The storage area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation.
- C The containers are elevated or are otherwise protected from contact with accumulated liquid.

B.14.2 Intent of RCRA Requirements

To ensure that storage containers do not remain in direct contact with precipitation collecting in the storage area.

B.14.3 NRC Requirements

See Section B.13.3.

B.14.4 Intent of NRC Requirements

See Section B.13.4.

B.14.5 Comparison of Intent

See Section B.13.5.

B.15 SPECIAL REQUIREMENTS FOR IGNITABLE OR REACTIVE WASTE

B.15.1 RCRA Requirements

40 CFR 264.176 requires that containers holding ignitable or reactive waste must be located at least 15 meters (50 feet) from the facility's property line.

B.15.2 Intent of RCRA Requirements

The intent of the RCRA requirements are twofold. First, to ensure that containers holding ignitable or reactive wastes are protected from off-site influences beyond the facility's control that could potentially promote a dangerous interaction with the stored wastes. Second, to ensure that members of the general public are protected from any releases or dangerous conditions caused by the accidental ignition or reaction of waste materials within the storage area.

B.15.3 NRC Requirements

NRC regulations and requirements related to ignitable or reactive wastes are contained in 10 CFR 20.1101, Information Notice 90-09, and NUREG SR1556 (V7-V13), and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to prevent and/or mitigate dangerous conditions or accidental ignition/reaction of waste materials within a storage area.)
- Because of the possibilities of decomposition products being generated over time, such as gas, and unfavorable chemical reactions occurring due to the storage of incompatible waste materials, licensees should evaluate what they are planning to store and use measures to prevent these reactions.
- It is expected that licensees will determine if it is necessary to install additional ventilation or fire protection/suppression system in the storage area if there is a possibility that gas generation or other reaction products might be released due to decomposition and chemical reaction of incompatible waste materials over time.
- It is expected that a radioactive waste management and disposal program be in place that includes procedures for handling waste, safe and secure storage of waste, waste characterization, minimization, and disposal of radioactive waste.

B.15.4 Intent of NRC Requirements

To ensure that licensees (1) incorporate engineering designs which account for the properties of the waste to preclude the potential for an explosion, and (2) implement operating procedures and controls to prevent and mitigate accidents.

B.15.5 Comparison of Intents

The intents of the two programs are equivalent in that both programs require facilities to implement adequate safeguards to ensure that ignitable and reactive wastes are safely managed. However, under the RCRA program, facilities are required to keep ignitable and reactive wastes a minimum distance from the facility boundary, whereas NRC requires licensees to prevent potential interactions with off-site factors through incorporating engineering design features and effective operating procedures.

B.16 SPECIAL REQUIREMENTS FOR INCOMPATIBLE WASTES

B.16.1 RCRA Requirements

40 CFR 264.177 establishes the following requirements:

- C Prohibits incompatible wastes, or incompatible wastes and materials, from being placed in the same container.
- C Prohibits hazardous wastes from being placed in an unwashed container that previously held an incompatible waste or material.

- C Requires that a storage container holding a hazardous waste that is incompatible with any waste or other materials stored nearby in other containers, piles, open tanks, or surface impoundments be separated from the other materials or protected from them by means of a dike, berm, wall or other device.

B.16.2 Intent of RCRA Requirements

To prevent hazardous reactions from occurring through either the direct contact/mixing of incompatible materials in a waste container or the incidental contact of incompatible materials from leaking containers.

B.16.3 NRC Requirements

NRC regulations and requirements related to incompatible wastes are contained in 10 CFR 20.1101, Information Notice 90-09, and NUREG SR1556 (V7-V13), and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such operating procedures and engineering designs necessary to prevent and/or mitigate dangerous conditions resulting from the accidental ignition/reaction of incompatible waste materials within a container.)
- Because of the possibilities of decomposition products being generated over time, such as gas, and unfavorable chemical reactions occurring due to the storage of incompatible waste materials, licensees should evaluate what they are planning to store and use measures to prevent these reactions.
 - It is expected that licensees will determine if it is necessary to install additional ventilation or fire protection/suppression system in the storage area if there is a possibility that gas generation or other reaction products might be released due to decomposition and chemical reaction of incompatible waste materials over time.
 - It is expected that a radioactive waste management and disposal program be in place that includes procedures for handling waste, safe and secure storage of waste, waste characterization, minimization, and disposal of radioactive waste.

B.16.4 Intent of NRC Requirements

To ensure that licensees (1) incorporate engineering designs which account for the properties of the waste to preclude the potential for an explosion (or dangerous reaction), and (2) implement operating procedures and controls to prevent and mitigate accidents.

B.16.5 Comparison of Intents

The intents of the two programs are equivalent in that both programs require facilities to implement adequate safeguards to ensure that incompatible wastes are safely managed. However, under the RCRA program, facilities are specifically instructed not to mix incompatible materials (or residues) and to maintain a system for the physical separation of incompatible materials, whereas NRC requires licensees to prevent potential interactions through the incorporation of engineering design features and effective operating procedures. Licensees also are subject to the hazard identification and worker safety provisions established by OSHA and are prohibited from mixing incompatible wastes (or materials) in waste containers subject to DOT requirements (e.g., LLW drums that will be transported to an off-site LLW storage or disposal facility).

B.17 CLOSURE

B.17.1 RCRA Requirements

40 CFR 264.178 requires that all hazardous waste and hazardous waste residues be removed from the containment system at closure. In addition, remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residue must be decontaminated or removed.

B.17.2 Intent of RCRA Requirements

To ensure that facilities do not pose a threat to human health or the environment after operations at the facility have ceased by requiring the removal of all hazardous wastes, residues, and contaminated materials (including liners, soils, etc.) from the non-disposal portions of the site.

B.17.3 NRC Requirements

NRC regulations and requirements related to decommissioning are contained in 10 CFR 20.1401-6 and include the following:

- C The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. (This requirement would include such engineering controls necessary to keep exposure to the public ALARA.)
- C A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are ALARA. Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.

B.17.4 Intent of NRC Requirements

To ensure that facilities undergo decontamination and decommissioning so that residual radioactivity is reduced to ALARA.

B.17.5 Comparison of Intent

The intents of the two programs are very similar in that facilities undergoing closure need to be decontaminated and decommissioned. Under the RCRA program, facilities must remove all RCRA hazardous waste and contaminated components from the non-disposal portions of the facility. However, for a site to be considered acceptable for unrestricted use under the NRC's program, licensees must decontaminate and decommission facilities so that (1) the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem per year, from all pathways, and (2) the residual radioactivity has been reduced to levels that are ALARA. As such, there is no specific requirement to remove non-radiologically contaminated materials; however, in the process of removing LLMW so that the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem per year, a large portion (if not all) of the RCRA hazardous component of the waste may also be removed. For example, in a typical decontamination process, concrete surfaces undergo scabbling to remove approximately the first inch of the concrete surface, which is where the bulk of

radioactive contamination (if present) exists (although deeper portions of the concrete and steel rebar can become activated or contaminated by liquids flowing through expansion joints or cracks in the concrete slab). This physically rigorous removal process should also remove the RCRA hazardous components of the waste (such as organic solvents) that might have been spilled at one time or another, especially since facilities are required to ensure that liquids are drained from storage areas and containment buildings and concrete floors and sumps, etc., are coated to make them impervious.

B.18 CONTINGENCY PLANNING

B.18.1 RCRA Requirements

40 CFR 264.51 through 40 CFR 264.56 require that hazardous waste facilities have up-to-date contingency plans that are designed and implemented to minimize hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water. The facility's contingency plan and emergency procedures should include/implement the following:

- C The plan must describe the actions facility personnel must take to comply with 40 CFR 264.51 and 264.56 in response to fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water at the facility.
- C The plan must describe arrangements agreed to by local police departments, fire departments, hospitals, contractors, and state and local emergency response teams to coordinate emergency services, pursuant to 40 CFR 264.37.
- C The plan must list names, addresses, and phone numbers (office and home) of all persons qualified to act as emergency coordinator (see 40 CFR 264.55), and this list must be kept up to date. Where more than one person is listed, one must be named as primary emergency coordinator and others must be listed in the order in which they will assume responsibility as alternates.
- C The plan must include a list of all emergency equipment at the facility (such as fire extinguishing systems, spill control equipment, communications and alarm systems (internal and external), and decontamination equipment), where this equipment is required. This list must be kept up to date. In addition, the plan must include the location and a physical description of each item on the list, and a brief outline of its capabilities.
- C The plan must include an evacuation plan for facility personnel where there is a possibility that evacuation could be necessary. This plan must describe signal(s) to be used to begin evacuation, evacuation routes, and alternate evacuation routes (in cases where the primary routes could be blocked by releases of hazardous waste or fires).
- C A copy of the contingency plan and all revisions to the plan must be maintained at the facility, and submitted to all local police departments, fire departments, hospitals, and state and local emergency response teams that may be called upon to provide emergency services.
- C The contingency plan must be reviewed, and immediately amended, if necessary, whenever the facility permit is revised; the plan fails in an emergency; the facility changes--in its design, construction, operation, maintenance, or other circumstances--in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency; the list of emergency coordinators changes; or the list of emergency equipment changes.

- C At all times, there must be at least one employee either on the facility premises or on call (i.e., available to respond to an emergency by reaching the facility within a short period of time) with the responsibility for coordinating all emergency response measures. This emergency coordinator must be thoroughly familiar with all aspects of the facility's contingency plan, all operations and activities at the facility, the location and characteristics of waste handled, the location of all records within the facility, and the facility layout. In addition, this person must have the authority to commit the resources needed to carry out the contingency plan.
- C Whenever there is an imminent or actual emergency situation, the emergency coordinator (or his designee when the emergency coordinator is on call) must immediately: (1) activate internal facility alarms or communication systems, where applicable, to notify all facility personnel; and (2) notify appropriate state or local agencies with designated response roles if their help is needed.
- C Whenever there is a release, fire, or explosion, the emergency coordinator must immediately identify the character, exact source, amount, and areal extent of any released materials. He may do this by observation or review of facility records or manifests, and, if necessary, by chemical analysis.
- C Concurrently, the emergency coordinator must assess possible hazards to human health or the environment that may result from the release, fire, or explosion. This assessment must consider both direct and indirect effects of the release, fire, or explosion (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated, or the effects of any hazardous surface water run-off from water or chemical agents used to control fire and heat-induced explosions).
- C If the emergency coordinator determines that the facility has had a release, fire, or explosion which could threaten human health, or the environment, outside the facility, he must immediately notify either the appropriate local authorities or the government official designated as the on-scene coordinator for that geographical area, (in the applicable regional contingency plan under part 1510 of this title) or the National Response Center (using their 24-hour toll-free number 800/424-8802).
- C During an emergency, the emergency coordinator must take all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur, or spread to other hazardous waste at the facility. These measures must include, where applicable, stopping processes and operations, collecting and containing release waste, and removing or isolating containers.
- C If the facility stops operations in response to a fire, explosion, or release, the emergency coordinator must monitor for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever this is appropriate.
- C Immediately after an emergency, the emergency coordinator must provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the facility.
- C The emergency coordinator must ensure that, in the affected area(s) of the facility that (1) no waste that may be incompatible with the released material is treated, stored, or disposed of until cleanup procedures are completed; and (2) all emergency equipment listed in the contingency plan is cleaned and fit for its intended use before operations are resumed.
- C The owner or operator must notify the Regional Administrator, and appropriate state and local authorities, that the facility is in compliance with paragraph (h) of this section before operations are resumed in the affected area(s) of the facility.

- C The owner or operator must note in the operating record the time, date, and details of any incident that requires implementing the contingency plan. Within 15 days after the incident, he must submit a written report on the incident to the Regional Administrator.

B.18.2 Intent of RCRA Requirements

To minimize hazards to human health and the environment resulting from fires, explosions, or any unplanned sudden, or non-sudden release of hazardous waste or hazardous waste constituents to the air, soil, or surface water by requiring the facility to maintain an up-to-date contingency plan (with detailed emergency procedures) that clearly designates the emergency coordinator who is responsible for ensuring that the contingency plan and emergency procedures are followed.

B.18.3 NRC Requirements

NRC regulations and requirements related to contingency planning are contained in 10 CFR 20.2203, 10 CFR 30.32, 10 CFR 40.31, and Information Notice 90-09, and include the following:

- C Corrective steps taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, ALARA constraints, generally applicable environmental standards, and associated license conditions.
- C Licensees must describe their procedures for responding to emergencies, including notification of and coordination with local fire, police, and medical departments.
- C Licenses must maintain an emergency plan for responding to a release of radioactive material.
- C It is expected that a Radiation Safety Officer will be designated who is responsible for implementing a radiation safety program and ensuring that radiation safety activities are being performed in accordance with approved procedures and license requirements.

B.18.4 Intent of NRC Requirements

To minimize hazards to human health and the environment resulting from fires, explosions, or any unplanned sudden, or non-sudden release of radiation to the air, soil, or surface water by requiring the facility to maintain an up-to-date contingency plan (with detailed emergency procedures) that clearly designates the Radiation Safety Officer as being responsible for ensuring that the contingency plan and emergency procedures are followed.

B.18.5 Comparison of Intent

The intents of the two programs are equivalent in that facilities under either program are required to both prepare a contingency plan with emergency procedures for dealing with releases resulting from fires, explosions, or any unplanned sudden, or not sudden event, and clearly identify the emergency coordinator.

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